cinefex
number 50
$6.95
Canada - $8.50

cinefex

...the journal of cinematic illusions

publisher
Don Shay

editor
Jody Duncan

contributing editors
Janine Pourroy
Mark Cotta Vaz

advertising director
Bill Lindsay

circulation manager
April Boice

CINEFEX 50 — May 1992. Published quarterly at P.O. Box 20027, Riverside, California 92516. Subscriptions (U.S.): four issues - $22; eight issues - $35; twelve issues - $50. Return postage must accompany all unsolicited manuscripts, photos or other materials. Printed by Valley Printers, Riverside, California; color separations by Select Color, Ontario, California. Contents copyright © 1992 by Don Shay. All rights reserved. Reproduction in whole or in part without written permission is prohibited.

A Message from the Publisher 8
Effects Scene: 64th Academy Awards 12
Video Beat: Morphing to the Music 18
Profile: Joseph Viskocil 23

Zealots and Xenomorphs 26

In the footsteps of Ridley Scott and James Cameron, novice director David Fincher set about to put his own personal stamp on the third installment in the *Alien* saga. Contributing to the *Alien 3* effects effort were creature creators Tom Woodruff, Jr. and Alec Gillis, physical effects experts George Gibbs and Al Di Sarro, and visual effects veteran Richard Edlund and his Boss Film Studios. *Article by Bill Norton.*

Cyberworld 54

Intent upon exploring the cinematic possibilities of 'virtual reality,' director Brett Leonard and producer Gimel Everett scripted and obtained independent financing for *The Lawnmower Man.* To infuse their film with a big-budget computer graphics look — without the big budget — they engaged digital effects teams at Angel Studios and Xaos, Inc. to realize the virtual environments. *Article by Peter Sorensen.*

Commercial Spot: Widebody Whales 75
Commercial Spot: Reflections of the Dead 82
Laser Revolution: Laserdisc Manifesto 86
Index: Cinefex 1-50 90

COVER — The alien xenomorph wreaks havoc on a prison colony in *Alien 3.* (Photograph by John Kleinman and Rob Powell.)

A MESSAGE FROM THE PUBLISHER

“If it ain’t broke, don’t fix it.”

For better or worse, that homespun adage has been a governing directive in my twelve-plus years as the guiding force behind Cinefex magazine. A great deal of thought went into the publication before its first issue ever saw the light of day. Reader response was immediate and positive, and the editorial stance and look of the magazine has remained substantially unchanged ever since. Until now.

In one of his celluloid musings, Woody Allen observed that a relationship is like a shark. It has to constantly move forward, or it dies. Perhaps the same could be said of any worthwhile endeavor, even publishing a film magazine.

Some months back, I was asked by Bill Lindsay why Cinefex carried no paid advertising. Advertising is, after all, the lifeblood of most periodicals. It was a question I had fielded many times before, and the answer was always the same. Because I didn’t want any. It was a purist’s response, maybe a naive one, but Cinefex had always been a reader-supported publication. I liked it that way. My readers liked it that way.

If it ain’t broke, don’t fix it.

Usually that was an adequate retort … but not for Bill Lindsay. Setting aside the issue of revenue, he argued that with Cinefex’s specific focus and reputation, by accepting advertising I could be providing a very real service, both to my readers and to purveyors of effects-related products and services.

I resisted. Bill persisted.

Even a cursory look at this issue will reveal who had the stronger will. After a year of gentle persuasion, Bill Lindsay has established Cinefex as a formidable advertising medium.

But the influx of new advertising is not our only change.

The least obvious, but most significant, is reflected on the masthead. After nearly thirteen years of hogging all the grief and glory associated with editing and publishing a successful periodical, I have relinquished the editorship of Cinefex to a very able successor, Jody Duncan. Jody has been with the magazine from the very beginning. From licking stamps and stuffing envelopes, she has progressed to associate editor and now editor. Her byline has graced sixteen of our better articles in the past six years, and my principal regret in elevating her to editor is that her new duties will necessarily diminish her output as a writer.

While she is dedicated to retaining the best elements of Cinefex as it stands, Jody has a fresh perspective and an abundance of new ideas, some of which are implemented in this issue. In-depth coverage of major effects films will continue to be our primary focus. However, in addition, we are initiating a number of shorter features designed to more fully cover our chosen field. There will be featurettes on films we might otherwise have had to pass by. There will be stories on cutting-edge effects in commercials and music videos. There will be profiles on people in the business. There will

be a column devoted to laserdiscs of interest to effects aficionados. And there will be more. A sampling of these new features is included in this celebratory fiftieth issue.

Fifty is one of those milestone numbers that invites reflection.

The rush I felt when the first Cinefex rolled off the presses in March 1980 has sustained itself through the years. With each new issue, the anticipation and exhilaration is renewed. That first slender volume has spawned a host of others that now occupy nearly a foot of bookshelf space — some 3600 pages of text and photographs that document for posterity a decade of unparalleled technological and aesthetic growth within the motion picture effects community. From my vantage point, it has been an exciting process to observe first hand.

I owe debts of gratitude to many people. To list them all would be a task too daunting even to consider, but a few of the most estimable merit special mention. Thanks first to Douglas Trumbull, a true renaissance man, who encouraged the notion of a special effects magazine and contributed heartily to the first issue and to many others. Thanks also to Richard Edlund, another master of the universe, a perennial advocate of Cinefex who stepped in at a critical juncture some years back to personally insure its continued existence. And my thanks to filmmaking giants James Cameron and Gale Anne Hurd and Steven Spielberg and George Lucas, creative forces behind the major effects films of our time, who recognized the value of what I was trying to do and embraced my efforts with unflagging support.

Beyond that, I must acknowledge the hundreds of filmmakers up and down the ranks who have made themselves available to probing interviews and idiot questions over the years. The magazine would, quite literally, be nothing without you. The same could be said of my writers. To the most prolific among them — Adam Eisenberg, Janine Pourroy, Paul Mandell, Paul Sammon — thanks a lot, guys. Only those of us who have suffered through it can appreciate the experience. I am likewise indebted to Ann Webb, teacher and friend, who has pored over every word in every issue — and has never seen any of the films we have covered.

Thanks finally to our loyal readers, many of whom have been with us since issue one.

Here's to the next fifty. What wonders will be wrought?

Don Shay

EFF*E.T.* SCENE:
64TH ACADEMY AWARDS

article by Don Shay

The sixty-fourth Academy Awards marked only the third time in history that a single film walked off with gold statuettes for best picture, best actor and actress, best director and best writer. It was a prodigious accomplishment — a cinematic grand slam — and a pleasant surprise to devotees of populist fare who generally see their favorites shut out come Oscar time. But only one award behind The Silence of the Lambs was *Terminator 2*, which made a comparable sweep of the technical categories by winning recognition for its accomplishments in visual effects, makeup, sound and sound effects editing.

Terminator 2 marks the third James Cameron film in a row to be honored with the visual effects award. “Generally speaking,” Cameron observed, “effects people are the unsung heroes of the business. Special effects, done correctly and in the right context, are as much of a star as the name players — but they are not treated with the same respect. After the Academy Awards, it was a rare article which mentioned that *Terminator 2* won the second highest number of awards. The headlines always read, ‘Silence of the Lambs wins five major Oscars’ — and the extrapolation of that is that we won the minor ones. It’s frustrating, because the technical aspects are just as important as the creative aspects.”

Though sharing a ballot slot with two other worthy contenders — Backdraft and *Hook* — *Terminator 2* was considered the odds-on favorite for the visual effects award. The scope and complexity of the work was enormous and the results were supremely satisfying. Accepting for the film were Dennis Muren of Industrial Light and Magic, Robert Skotak of 4-Ward Productions, Gene Warren of Fantasy II and Stan Winston of Stan Winston Studio.

Dennis Muren who oversaw the computer graphics effort, was no stranger to the ceremonies. In the past twelve years, he has made seven trips to the Oscar podium and is clearly the most honored man in the field. Even after such ongoing recognition, however, Muren remains humbly appreciative of the Oscar experience. “The first one I got, for *The Empire Strikes Back*, I actually kept in a drawer for a year because I just couldn’t believe I’d won it. It’s as exciting now as it was then — a real honor — but I realize that it’s sort of like a club, and that you have to work on films of a certain stature even to get nominated. So while I’m honored to be recognized by my peers, I have no delusions about it, either.”

The liquid metal T-1000 had presented Muren with possibly the greatest challenge of his career — creating a viable character through computer graphics technology that had yet to be proven. Cameron, himself, who had dreamed up the character, had reservations about whether or not existing technology could provide what he had envisioned. “I went into the T2 project with some trepidation, but I had a gut instinct that Dennis Muren could pull it off. Even at that, I fully expected that maybe eight out of ten of the computer generated shots would be effective — and it turned out that ten out of ten of those shots were effective. Everybody worked incredibly hard.”

Although he had confidence in his team's capabilities, Muren had prepared for the possibility that the computer generated shots might not succeed. "I felt we could do it, but I also had traditional backups for all the shots. In the end, though, everything that Jim asked for, we got on film. T2 was a breakthrough, both in computer graphics and in digital compositing. Being able to finally digitize computer generated images successfully at full theatrical resolution showed that this little sub-industry had matured. T2 was the most exciting and rewarding project I'd ever worked on — and it was just the beginning. Wherever we point this computer graphics technology, it succeeds. I suppose at some point we're going to hit a wall; but it hasn't happened yet."

Three of the four award winners had already won for previous Cameron outings — Robert Skotak and Stan Winston for *Aliens* and Dennis Muren for *The Abyss*. The only first-time honoree was Gene Warren — another Cameron regular — who supplied the future war effects and the tanker truck crash. Warren anticipates that the award will mean expanded opportunities for Fantasy II. "Winning the Academy Award will give us more credibility within the business. Oftentimes, producers will go to a place like ILM, not just because they are good, but also because it's a safe choice. No matter what happens with the effects, the producer won't be blamed for it. 'Hey, we hired Marlon Brando, and this time he delivered a bad performance. It's not my fault.' Winning the Oscar puts us in a category where people will not be going out on a limb, personally, to hire us."

Like Gene Warren, Stan Winston's association with Cameron dates back to The *Terminator* for which he constructed the robotic endoskeleton, as well as appliance makeups and puppet doubles for Arnold Schwarzenegger. For *Terminator 2*, Winston was called upon to create similar, but more advanced effects, along with a number of puppet creations that would serve to support the T-1000 computer graphics elements. As enthusiastic as Cameron had been about the use of computer generated imagery, he had realized from the outset that Winston's contributions to the T-1000 effects would be vital. "I had learned enough about computer graphics to know that you have to take your 'all-star' shots — which tend to be expensive — and shore them up with a variety of less expensive effects. So we brought Stan in to do a lot of animatronic and prosthetic effects to merge with the computer graphics. We stretched the animatronics in one direction and the graphics in the other direction until they mated somewhere in the middle."

In addition to his second win in the visual effects category, Winston also took home his first makeup Oscar — shared with Jeff Dawn — for the appliance makeup work on Arnold Schwarzenegger. Within the Academy, the distinction between makeup and visual effects has been a bone of contention in recent years, especially as makeup technologies have expanded to include mechanical articulation devices. For Winston, this year's dual recognition signified a clear acknowledgment of the two distinct, yet closely related disciplines which make up his line of work. "The most positive thing about this year's awards was that they helped to clear up the confusion about what is makeup and what is effects. There was a time when this whole aspect of effects was in limbo — effects people did not consider it effects; makeup people did not consider it makeup. This year, the makeup was recognized for its contribution, and the effects were recognized for their contribution. So it was a breakthrough year; and, hopefully, it will encourage the Academy to look at what we do as something other than a limbo kind of technology."

Makeup artist Jeff Dawn — who was responsible for applying the makeups — had also worked on the original *Terminator*. In fact, that film had presented the young artist with his first big break. He

has since continued to work with Schwarzenegger on nearly all of his films. “Jeff is an exceptionally good makeup artist,” Winston noted, “who did a really excellent job of applying that complicated makeup every day. He is deserving of the recognition and of the award. It was a very difficult illusion to create, both artistically and technically.”

Terminator 2 was also recognized both for sound and sound effects editing. The Oscars went to Tom Johnson, Gary Rydstrom, Gary Summers and Lee Orloff in the sound category, and to Gary Rydstrom and Gloria S. Borders for sound effects editing. It perhaps makes the honor all the more gratifying that the film was mixed, at Skywalker Sound, in an unprecedented length of time. "Gary's team mixed that movie in four weeks," noted Cameron, "which is impossible. Anybody would tell you that. You can't predub for two weeks and then dub a reel a day for a six-track mix on a major picture. It just doesn't happen. The fact that they did it so well is a tribute to how together they were. They flew in a lot of sound effects at the last second and created things almost in real time. It was a real high-energy mix."

For many effects enthusiasts, the emotional high point of the evening came when stop-motion animator Ray Harryhausen was honored with the Gordon E. Sawyer Award for a lifetime of technical contributions to the film industry. In a prolific career which spanned five decades — from *Mighty Joe Young* to *Clash of the Titans*, with many an excursion into prehistory and mythology along the way — Harryhausen brought to life dozens of wondrous characters that have served as inspiration for a whole generation of effects artists. Arguably the first 'superstar' of the field — an effects artist whose name on a film carried more weight than either its director or its stars — Harryhausen was never honored with an Academy Award. More astonishingly, he was never even nominated. High school teacher Arnold Kunert, a longtime Harryhausen fan, decided to address that oversight. Late last year, he launched a grass-roots letter writing campaign to convince the Academy Board of Governors that Harryhausen was deserving of special recognition for lifetime achievement. After first enlisting writer Ray Bradbury — a friend of the effects artist's since high school — Kunert solicited and obtained more than seventy letters from prominent filmmakers and effects people, all of

Academy Awards for best visual effects, makeup, sound and sound effects editing went to Terminator 2.

whom attested to Harryhausen's worthiness for consideration. The end result was his selection as the recipient of the Sawyer award.

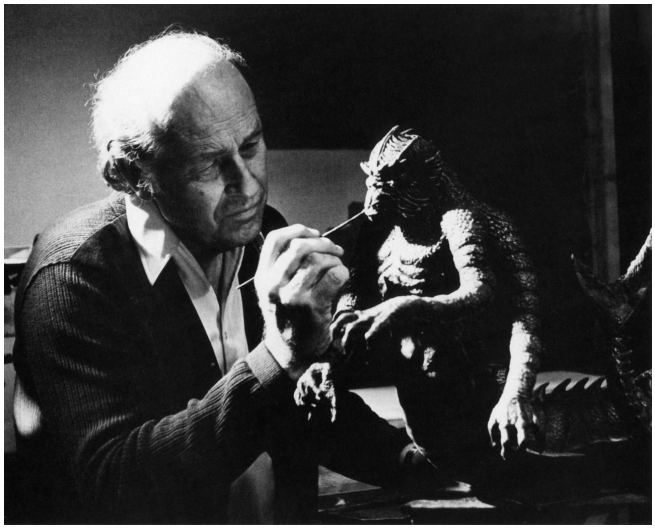
Although Harryhausen has effectively retired from filmmaking, he has busied himself during the past decade revisiting the various creatures which have populated his films. Because many of his puppets were cannibalized for armature parts and most of his molds were destroyed for lack of storage space, Harryhausen has meticulously resculpted such favorites as the rhedosaurus from The Beast from 20,000 Fathoms, the cyclops from *The 7th Voyage of Sinbad*, Talos from *Jason and the Argonauts* and the Kraken from *Clash of the Titans*. Working in wax, he then makes castings in museum-quality bronze for both permanence and posterity.

Despite such satisfying endeavors, Harryhausen still has an occasional longing to make another film. "I often get the urge to start a new project; but then I think of the time it takes to prepare for something like that and how much money is at stake." Though he admires the work being done today, Harryhausen acknowledges that the approach is quite different. "It sometimes amuses me to watch screen credits rolling up and see that there were about eighty people doing what I used to do alone. I would have an electrician who kept the lights from going out, but all of the stop-motion and the photography and the setups I would do myself. I never wanted to get into delegation. I felt the animation was too personal and I got into the habit of working that way. Today there's a lot of concern about production money being tied up for long periods of time. That was a problem even in the old days, but I always had about a year to do my work."

More than a decade after his last film was released, Harryhausen is warmed, not just by the Academy Award, but by less formal tributes being paid to him by the new generation of special effects people. "I recently received a beautiful present from the fellows at ILM. It was a picture of myself, with all their signatures around the border — and so many of them noted that my films had influenced their choice of career. Willis O'Brien did that for me — so I guess the snowball rolls on. One of the pleasures now, aside from awards, are the letters I get saying how the films I did have changed people's lives. I think that's rather touching. We set out to make some entertainment, but people find much more in the films than just an hour and a half of pleasure."

Though the Harryhausen award was actually presented three weeks prior to the televised Oscar ceremony, his acceptance of it, and a sequence of clips from his films, was broadcast on Oscar night. Other awards presented at the earlier ceremony were for scientific or technical achievement. Among the nine plaques and five certificates were five given specifically for effects-related contributions.

Richard Keeney and Richard J. Lundell of Management Graphics and Ray Feeney of RFX were awarded a plaque for software development and adaptation of the Solitaire film recorder which transfers computer graphics to film. Through the years, as the demand has grown for computer animation in motion pictures, effects companies have had to build their own film recorders — often bulky devices that required high maintenance and a high level of operative know-how — because there was no standard equipment for the purpose. Now an off-the-shelf Solitaire unit — designed originally for still photographic applications — can be fitted with a stock Oxberry animation head to provide a cost-effective, user-friendly way of recording computer images onto motion picture film. At present, approximately two dozen of the film recorders, upgraded with the animation head package and attendant software, are in use within the visual effects community.



Stop-motion animator Ray Harryhausen, recipient of the Gordon E. Swayer Award for lifetime technical achievement, at work on Clash of the Titans.

Also recognized were Faz Fazakas, Brian Henson, Dave Housman, Peter Miller and John Stephenson for their development of the Henson Performance Control System — a high-tech computerized radio control mechanism that allows a single puppeteer to operate a character that in the past might have required up to five puppeteers. The system, which enables the operator to coordinate up to thirty-two separate facial movements, was developed at Jim Henson's Creature Shop in London where it has been used on such films as *Labyrinth* and *Teenage Mutant Ninja Turtles*, and the television series *Dinosaurs*.

Thomas Hahn, Peter Nye and Michael Shantzis of Pixar, along with Randy Cartwright, David B. Coons, Lem Davis, James Houston, Mark Kimball and David F. Wolf of the Walt Disney feature animation department received awards for the design and development of the Computer Animation Production System (CAPS). Years in development, CAPS has revolutionized the way animated films are made, streamlining the process as well as enhancing the fidelity of the animated characters. Rather than hand-painting thousands of individual animation cels — an arduous and painstaking process — CAPS allows hand-drawn pencil images and painted backgrounds to be scanned into a computer where they are electronically colored, adjusted and manipulated. Camera moves such as pans and zooms are also rendered in the computer, as well as special effects such as shadows and rippled glass effects. The completed images are then transferred directly to film stock, eliminating the need to photograph cels individually. The system was inaugurated with *The Rescuers Down Under* and used extensively in Beauty and the Beast.

Academy certificates for technical achievement were awarded to Robert W. Stoker Jr. for his development of a new cobweb gun. In the past, movie cobwebs have been created by spraying a rubber-cement-based substance through a fan onto targeted areas on the set. The drawbacks of the technique were numerous — not only was the rubber cement substance toxic and highly flammable, it also created cobwebs that were often too fragile for the rigors of filmmaking. Cleanup

was also extremely difficult. Stoker's invention uses compressed air to blow fine strands of hot glue through a special glue gun. The effect is very durable, nontoxic, nonflammable and easy to clean up. To date, the cobweb gun has been used on such films as *Arachnophobia* and *Child's Play 3*.

James Doyle of Landmark Entertainment Group's *Roboshop* received a like award for his innovative liquid nitrogen Dry Fogger. Unlike previous fog machines, the Dry Fogger does not use chemicals, oils or dry ice bases — all of which produced moisture and/or noxious gases that can be hazardous to cast and crew members. Only nitrogen — a natural ingredient in the air — and water vapor are employed in the new device, creating a safe and dense fog for on-set use. Because it does not employ expensive chemicals, the Dry Fogger is also more economical than previous devices. It has been used in Flight of the Intruder, *Terminator 2* and *Hook* — as well as the Academy Awards ceremony.

VIDEO BEAT:
MORPHING TO THE MUSIC

article by Jody Duncan

One day last August, Pacific Data Images, a major player in the digital effects field, received a somewhat naive telephone call from Propaganda Films. “What’s involved in this ‘morphing’ technique,” they wanted to know, “and what if we wanted to do fifteen of them?”

Propaganda was about to embark on the making of Michael Jackson’s *Black and White* — an imaginative and ambitious music video that would once again pair the pop superstar with director John Landis who had spearheaded his *Thriller* extravaganza. Specifically, what the filmmakers envisioned was a nearly minute-long sequence at the end of the piece in which people of different ethnicities would be featured singing and dancing and transforming one into another. Illustrating each person’s individuality and sameness, the sequence was to be a fitting thematic punctuation mark to Jackson’s upbeat song about racial harmony.

The sequence was ideally suited to the morphing technique, which entails computer interpolation between two distinct film images to create a seamless transformation from one to the next. Morphing had been around for several years — introduced subtly in *Willow* and then stunningly showcased in *Terminator 2*. The effects people at PDI had been applying the technique in a variety of commercials when the call came from Propaganda. “They invited us to a meeting with John Landis,” recalled digital effects supervisor Jamie Dixon, “and we went back for two or three meetings after that. Fortunately, everyone at Propaganda understood that this was going to be the most time-consuming aspect of the video, so they got us involved really early on.”

Eighteen racially varied individuals were photographed on a tiny stage, with PDI members on hand to ensure that the footage — by cinematographer Mac Ahlberg — would be workable from a digital effects perspective. “The setup was straightforward,” noted Dixon. “The people stood about thirty feet in front of a gray background. There was music playback of this segment of the song, and they would go through the whole thing as many times as it took to get good reactions from them. We spent an entire day shooting these eighteen people, and we went through an amazing amount of film.” Although a nominal attempt was made to line the actors up to one another, the shoot was not geared specifically to the exacting demands typical of computer graphics. “None of it was really figured out beforehand. We didn’t know, for instance, that this particular guy was going to turn into that particular woman, who in turn would become that particular woman or guy. We didn’t have any idea about who was going to follow who. All of those decisions were made after we shot the footage. But the beauty of morphing is that exacting requirements are removed. Conceptually, a morph distorts an image as it goes through a transition and that distortion keeps everything lined up during the transition. So you don’t have to be quite as careful in the original photography.”

As editor Dale Beldon went through the miles of footage, PDI sat in on the two-day editing session, giving input as to which individuals might transition most readily into the next. “Dale would ask us questions like, ‘Is it okay to go from her to him?’ What we were most concerned about was that their actions be somewhat similar — we didn’t want to have someone looking left going into

someone looking right. We were very conscious of people facing in the same direction and their actions lining up."

The completed three-quarter-inch tape edit featured thirteen of the original eighteen actors in the precise order in which they would appear in the finished video. Standard video dissolves were employed to suggest the transitions that would ultimately be realized through morphing. Upon seeing the finished cut — complete with music, dissolves and polished takes of the actors — Dixon was somewhat unsettled. "It was the first time we'd seen all of the people together. The footage was so good and so interesting to look at, and the presence of each of those people was so remarkable, that all I could think was, 'How are we ever going to make this better than it already is?' Once we had this cut, our job was really reduced to a technical exercise."

Because the image processing was to be done at video resolution, that 'technical exercise' involved transferring the film to D-1 tape which was subsequently scanned into an Abekas A-60 digital disk recorder. "Our computers could then talk directly to the A-60, and we could get the frames into the computer one at a time." Working on Silicon Graphics Personal Iris computers, animators George Bruder, Barb Meier, Amie Slate, Neil Eskuri, Ray Giarrantana, Janet Rentel and Rebecca Marie labored for an average of two weeks on each morphed transition. "Each of our computers has a high resolution monitor, so the images are all laid out. The program provides a lot of feedback so we can see what we are doing. Usually we would work with low resolution frames because it was faster. We would set everything up, let the computer run overnight, then come back in the morning to see what we had and make our adjustments from there."

One of the complications of the process was that, unlike subjects to which PDI had applied morphing techniques in the past, each of the performers in the music video was moving around significantly. That movement required the animators to track specific facial features frame by frame. "An animator would identify where an eye was in a particular frame and where it was in the next frame, then the next, and so on. Typically, if you have a morph transition that is thirty frames long, you set the first frame and the last frame. Then you set the middle frame and the computer interpolates between them — ideally, there's no need to specify every frame. But with these guys, there were a number of sections where we had to go in and do every single frame because they were doing some very irregular movement." The transitions ranged from twenty-eight to ninety frames in length. "Basically, we would make the transition last as long as the people were doing roughly the same thing — and they were never lined up for more than three seconds at a time."

Another difficulty encountered was in the radically different hairstyles from one subject to the next. "We had to go from the thin black woman, who had her hair tightly pulled back, to the red-haired woman with a full head of curly hair. So on our first time through, we ignored the hair completely; and what we got was the features of the face transforming perfectly, but the red hair just dissolving on — which broke the quality of the effect. So we went back and did a second pass, isolating just the hair and doing either a second morph on that or a roto-reveal where we could etch it on in a few frames."

In all, the transformation sequence took two full months to complete, with PDI working right up to their deadline. "There was never any fear that we wouldn't complete it on time," Dixon concluded, "it was just a matter of trying to get it better. I still see a billion things we could have improved

upon. It was a challenge, and I think our work did enhance the sequence. But we started with something that was really high quality — both visually and conceptually. If you have bad looking images, morphing will not fix them. We had gorgeous pictures to start with, so it would have been kind of hard for us to fail."

For the Michael Jackson music video, Black and White, Pacific Data Images was commissioned to 'morph' thirteen young people of varied racial and ethnic backgrounds, transforming them sequentially from one to the next in a seamless, uninterrupted segment lasting nearly a minute. Vast differences in physical stature and hairstyle, coupled with the performers' jubilant dance moves, served to complicate the assignment.

PROFILE:
JOSEPH VISKOCIL

article by Jody Duncan

There was nothing in Joe Viskocil's childhood to suggest that he would one day be creating giant nuclear-like explosions in the middle of the desert or blowing up cars and buildings in the course of a normal workday. There were no schoolboy pranks with matches in the garage, no ill-advised experiments with Fourth of July fireworks. There was only an intense fascination with the movies — particularly, Saturday afternoon serials.

Born in Chicago in 1950, Viskocil was soon relocated with his family to Southern California. His interest in movies eventually led to Voyage — a five-minute short that he made in high school. "I borrowed the 16mm camera that my school used for football games and photographed all these models of spaceships and planets. I would work on the film during my art period, and everyone thought I was crazy." Viskocil was proved anything but crazy, however, when Voyage was honored with the Costa Mesa Film Festival award for best experimental film.

Near the end of his two years at Mt. San Antonio College, where he studied drama and photography, Viskocil received a phone call from a friend asking if he would like to work on a low-budget venture titled *Flesh Gordon*. "I was just brought in to do miniature props and set construction — hammering nails kind of stuff. It was a great learning experience. There were no special effects supervisors on the film — anyone who had an idea of how to get a shot would just go and do it. I took two weeks off from school to work on the film, and I remember thinking that I had learned more in that two weeks on a movie set than I had in my entire two years in college."

Among Viskocil's unofficial instructors on *Flesh Gordon* were modelmakers Greg Jein and Tom Scherman. Scherman had built a castle model that was to be blown up at the end of the film. Anxious to try his hand at the feat, Viskocil persuaded Scherman to let him tackle the assignment. With virtually no pyrotechnic experience behind him, Viskocil nonetheless achieved a successful detonation. He came away from the experience convinced that the way to get into the movie industry was to master one small element of it — namely, miniature pyrotechnics. "Nobody was really doing miniature pyro at the time — there just wasn't much call for it. But I decided to teach myself everything I could about it, assuming that there would be a call for it in the future."

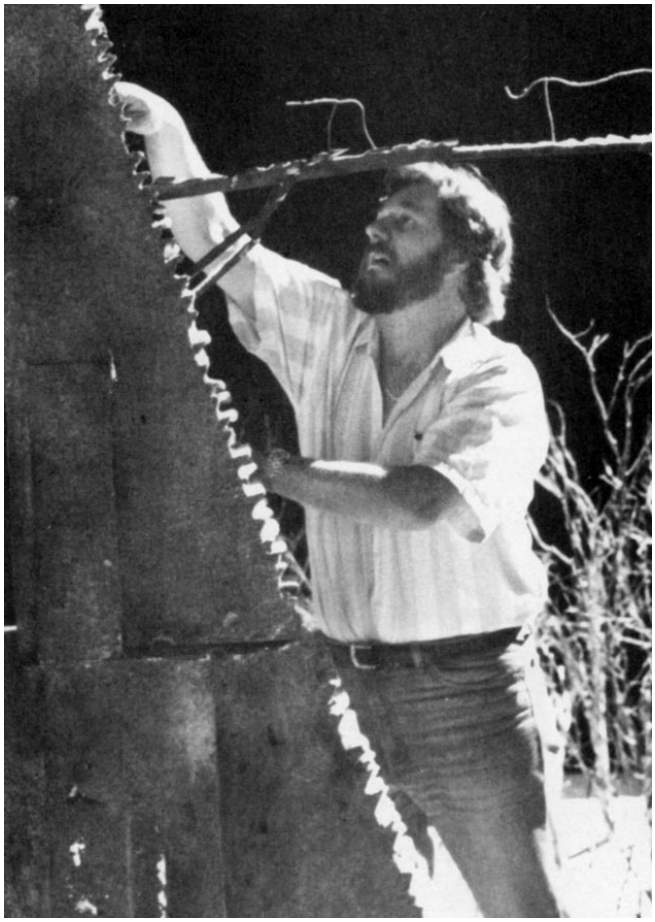
It was an amazingly astute assumption. Within a few years, *Star Wars* was to instigate a filmmaking trend in action-packed pyrotechnics that reverberates in the film industry to this day. Although Viskocil had only *Flesh Gordon* and a few Saturday morning television credits to his name, *Star Wars* producer Gary Kurtz gave him the opportunity to show his acumen in a one-day miniature pyro test. "If it weren't for Gary Kurtz, I probably wouldn't be where I am today. When he saw what the possibilities were with that test, I was brought onto the film." It was while working on *Star Wars* that Viskocil developed what has become known as the 'zero gravity' explosion. "It's a process where the camera faces the ceiling, and the explosion takes place directly above it. When one of those shots was shown in the screening room one day, everyone started screaming: 'There's our Deathstar!

There's our Deathstar!' I didn't even know what the Deathstar was because *Star Wars* was such a top secret film."

The *Star Wars* experience was both an entree to the film industry and a career highlight. "When I saw *Star Wars* for the first time with an audience, it was at Grauman's Chinese and it was a packed house. When the Deathstar blew up — which I had done — the entire audience burst into applause. It was a major high. And when the film was over and everybody was clapping, my friend Mike Minor turned to me and said, 'All I want to do right now is put you on my shoulders and carry you out of the theater.' So that was my fifteen minutes of glory. And that was when I realized that I was going to stay in this industry, even if it meant no food on the table."

Although he occasionally had to find work in other areas of the film business — such as model building and set construction — Viskocil gradually established a sound reputation as a miniature pyrotechnician. Most of the major effects films of the past decade — *The Empire Strikes Back*, *Ghostbusters*, *2010*, The *Terminator*, *The Abyss*, *Total Recall* — all bear his credit. In recent years, he has graduated to larger-scale pyrotechnics, such as a cataclysmic nuclear explosion he staged for *Terminator 2*. "I often get recommendations, because people I have worked with know that I am reliable and safe." He is currently broadening the scope of his expertise to include a wider range of on-stage natural effects, such as wind, fog and rain.

Joe Viskocil brings what he calls an 'old-fashioned' philosophy to his work. "The big thing now is CGI, and I think things are starting to look a little sterile. It's too clean and too flawless. In the old days, when they would blow up a model in the backlot of Republic for the serials, it looked fantastic. It was so real and it was all in-camera. There were no opticals or computer graphics or bluescreen elements. I think eventually people will realize that the future of effects is not in expensive CGI and opticals, but in the old style of doing things."



Joseph Viskocil wires explosive charges into a miniature set built for Batman Returns.

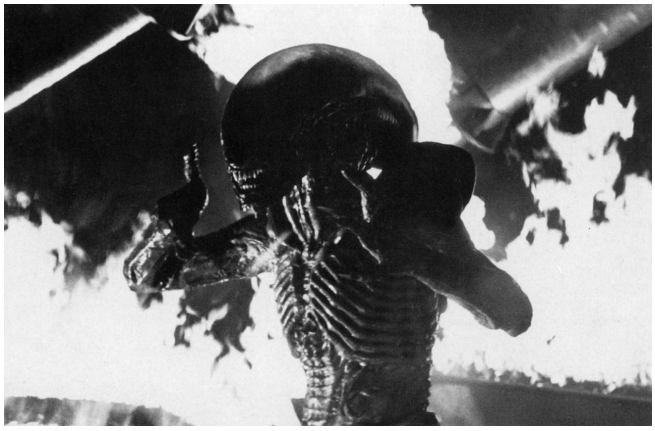
zealots & xenomorphs

image

article by

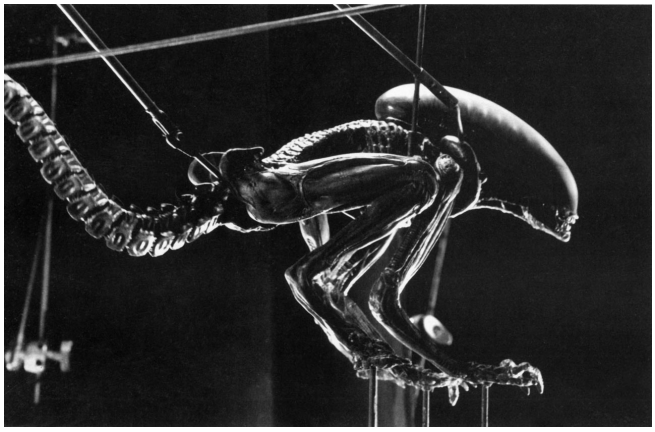
Bill Norton

Inherent in the making of both *Alien* films to date has been the tricky proposition of how to convincingly realize the distinctly nonhuman alien beast, one of the most menacing and disturbing movie monsters of all time. Under the direction of Ridley Scott, the nightmarish xenomorph in the original *Alien* was created utilizing a carefully crafted costume coupled with animatronic enhancements. The success of the man-in-a-rubber-suit approach — often much maligned — was attributable in large part to the fact that Scott had revealed his creature almost entirely in tight closeups. Seven years later on *Aliens*, James Cameron, who wrote and directed the sequel, was to rely similarly on costumed performers. Although the awesome alien queen featured in that film's climax was realized through marionette and rod puppet techniques, the bulk of the action involved a veritable army of alien warriors portrayed by stuntmen and acrobats in simple latex and foam costumes made believable by lightning-quick cuts and dark, shadowy lighting.



More than one seasoned filmmaker had fallen out of Alien 3 before it was delivered into the hands of novice director David Fincher, whose trial by fire included a grueling thirteen-week shoot followed by nearly a year of second unit and postproduction effects work. Among the challenges faced was the creation of the alien predator — inadvertently unleashed when an escape module carrying Ripley and the other Aliens survivors crashes on a remote prison planet. As with its predecessors, the xenomorph in the latest series entry was to be portrayed largely by a performer in an alien suit, constructed by Tom Woodruff, Jr. and Alec Gillis of Amalgamated Dynamics.

Appropriately, *Alien 3*, the current series entry, was to draw from both prior efforts even as it attempted to surpass them. Unlike its predecessors, *Alien 3* was to invite close scrutiny of the beast, featuring it on the screen and integrating it into the settings and live-action to an unprecedented extent. Also, while continuing the tradition of achieving closeups of the creature with convincing costumes, the third installment was to deviate from the style set forth in the previous two by portraying a much more insectlike version of the warrior, employing advanced matting techniques to effectively place a motion controlled rod puppet into a number of key scenes.



Although the detailed suit was effective for closeup shots, more revealing full-length views of the creature's spindly form called for state-of-the-art rod puppet techniques developed by visual effects supervisor Richard Edlund and his team at Boss Film Studios.

The effects challenges in *Alien 3*, however, did not end with just the creature itself. A multitude of physical and optical effects would ultimately be

produced. Hoping to sustain the success of the series, producers Gordon Carroll, David Giler and Walter Hill — who had served in like capacity on the two previous *Alien* outings — brought together an experienced and accredited filmmaking team. An early recruit to the project was production designer Norman Reynolds, a multiple Oscar winner who had worked as art director on *Star Wars* and *Superman*, and then moved up as production designer on the two *Star Wars* sequels and *Raiders of the Lost Ark*. To supervise the on-set physical effects, the producers chose George Gibbs who, although a newcomer to the *Alien* saga, had a long list of impressive credentials including work on the last two Indiana Jones films, Who Framed *Roger Rabbit* and *Brazil*. Selected to provide the high-caliber alien effects were Tom Woodruff, Jr. and Alec Gillis — both *Aliens* veterans — while the film's extensive miniature and visual effects were awarded to effects supervisor Richard Edlund and his Boss Film Studios.

Even with the impressive support staff and the proven track record of the *Alien* franchise, finding a suitable helmsman for the project proved problematic. Directorship of the film passed from Renny Harlin to Vincent Ward before finally going to David Fincher, a twenty-eight-year-old former effects technician with no previous feature film directing credits. After a four-year stint at Industrial Light and Magic, Fincher had moved on to directing commercials and videos, a well-received Paula Abdul video being his primary claim to fame. It was with this solid, but narrowly defined filmmaking background that Fincher went into *Alien 3* — a massive production, which, at $63 million, would cost more than twice as much as the first two films combined.

Slated to shoot at Pinewood Studios in England, the project went through multiple iterations and repeated delays before principal photography finally began in January 1991. No fewer than three distinct drafts of the script were commissioned in the project's early stages. In fact, one version of the story, in which Ripley was to crash-land on a man-made wooden planet inhabited by exiled monks, was taken well into preproduction under Vincent Ward's stewardship. Having demonstrated an affinity for the medieval motif in his film *The Navigator*, Ward's vision for *Alien 3* was similarly gothic. Effects teams had already submitted budgets and designs for the darkly mystical tale when Ward departed abruptly and Fincher took over the project. The change in leadership brought with it changes in the storyline. While retaining some of the religious undercurrents of the prior script, Fincher chose to steer the film in a markedly different direction. "I didn't feel Ward's ideas made sense in terms of the previous movies. Some of them were really interesting, but to send that much teak into outer space never made sense to me. I liked the religious aspect, although much of it was subsequently thrown out."

A rewrite of the script, influenced strongly by Fincher, resulted in religiously zealous prisoners taking the place of exiled monks. Sentenced to serve time at a work station on a remote, barren planet, the inmates — each with a violent history — bear the loneliness of their existence by strict adherence to a severe spirituality. Ripley crashes into this grim, all-male, low-tech environment and must form a dubious alliance with the inmates to destroy the alien that she has unwittingly brought with her. "The idea of no technology, of rubbing sticks together to make fire in the bowels of an oil refinery, appealed to me," Fincher commented. "We all agreed that we wanted to do something that was dark, mean and adult, trying to return to the simplicity of the first movie — although we knew that we'd never be able to do something as elegant. There were too many loose strings to tie up and a lot of expectations to fulfill."

It was not only the changes in leadership and storyline, but also a hasty preproduction period — a consequence of the availability of actress Sigourney Weaver — that set *Alien 3* off on a rocky start. A series of late script rewrites and design changes plagued the filmmakers right up to the start of principal photography, and the project never fully recovered from the lack of solid planning. "The whole movie was a matter of hitting the ground sprinting and making the best decisions we could," said Fincher. "When I got to England, I went to the stage to see if there were any usable sets — and I found that the gothic columns built for Vincent Ward had just been ripped down and thrown away. So I was trying to get sets started in construction that would be somewhat multipurpose since we still didn't know where the story was going. We started shooting with only forty pages, and the script changed so much and so fast that we were receiving stuff off the fax machine and shooting it the next day. It was just insane. I did a lot of 'Bay of Pigs' stuff — hit the beach, get as many confirmed kills as possible and move on."

Adding to the show's many problems was the fact that, unhappy with the course of events, the producers left England shortly after completing the screenplay. Twentieth Century Fox, the financial backer and distributor of the film, stepped in to interact directly with Fincher. "The missing link was the guy who understood what was happening on a daily basis and could interpret that for people whose primary obsession was to make sure that the financiers were getting the maximum amount for what they were putting in. That's why you hire a producer you trust. Fox didn't really have the language to be able to speak with me and they weren't even there. The key to the whole thing is how much they want to believe in you. And who was I? Some twenty-eight-year-old guy who shoots commercials and did the Paula Abdul video. I just didn't have much credibility."

The effects artisans, too, suffered the consequences of the film's shaky beginnings. "There was a lot of crisis management involved with the production," noted Richard Edlund. "There were delays, new decisions and changes of release date. The production started off with one director, one producer and one director of photography; and all three of those changed at various times. The opening of the movie went through about three variations, so we did a lot of different designs. All of this hurt us to some degree; but then David Fincher came onto the project. He was an exciting addition to the show for us, because he knows a lot about effects and understands how to get the most out of them. And he is a great talent, visually."

The script that was finally pinned down and shot picks up where the previous film ended — with Ripley, Hicks, Bishop and Newt all in hypersleep aboard the Sulaco. An opening montage suggests an alien-instigated emergency aboard the ship. The ship's computer automatically jettisons the four *Aliens* survivors in an emergency escape vehicle, which subsequently crashes into the ocean on Fiorina, an unpleasant and remote planet where the largely inactive Fury 161 correctional work facility is manned by a mere handful of resident inmates. As sole survivor of the EEV crash, Ripley comes to realize that she has brought the alien infestation with her — not only a warrior who is growing to lethal maturity in the facility's ventilation system, but also a queen embryo developing within her own abdominal cavity. With virtually no weapons, Ripley and the inmates attempt to destroy the alien predator, even as the beast reduces their numbers in a series of grisly attacks.

The crash of the escape module and its subsequent retrieval onto shore was the only sequence slated to be shot off the Pinewood lot. The crash, in particular, was designed as a composite, with a miniature EEV to be shot during postproduction, backed by an ocean element filmed off the coast of

England, in the North Sea. George Gibbs' physical effects team was responsible for creating the explosions at sea that would simulate the impact of the craft hitting the water. "The director wanted enormous explosions," said Gibbs. "Some were as big as eighteen hundred feet wide, with water towers that went one hundred twenty to one hundred fifty feet in the air. We were using about three hundred pounds of dynamite and four reels of primer cord for each blast. It was difficult, because Fincher wanted a really rough sea and it was nearly impossible to work in those conditions." A plate crew from Boss, headed by effects cosupervisor Rick Fichter, was on hand to photograph the explosions with a newly developed field recorder motion control system.

Because of its unusual, otherworldly look, a beach at Newcastle was chosen for the scene in which the damaged EEV is pulled on shore. "It was a terrific looking spot," said Fichter. "There had been a colliery nearby and they had dropped all their slag onto the beach. So the sand was black and the water had a really brackish look to it." A full-size EEV was constructed by the physical effects crew for the sequence. "The EEV was quite difficult to build," explained Gibbs, "because Norman Reynolds got away from the aerodynamic in his design — the ship looked somewhat like a door hinge. One end of it — where it had hit the sea — had to be crushed. We made that end out of aluminum and the rest of it out of steel because that was the easiest and most economical way to get the shape. When the set dressers were finished with it, it was unrecognizable anyway, because it was covered in seaweed and all sorts of other rubbish." Miniature and matte painting work in postproduction enhanced the beach and the full-sized EEV footage.

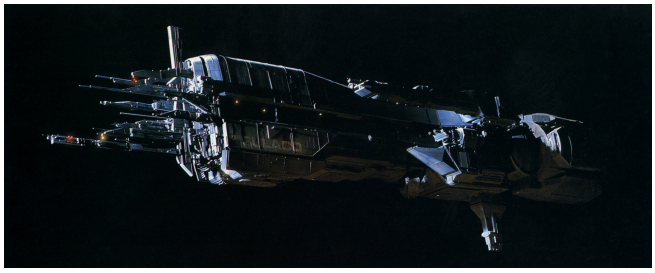
Ripley is attended to by the Fury 161 medical officer, Clemens (Charles Dance), and awakens from unconsciousness to find both Hicks and Newt dead. Fearing the worst, she insists that Clemens perform an autopsy to verify that there is no chest-burster within the child's body. The corpse was just one of the many effects created by Tom Woodruff and Alec Gillis of Amalgamated Dynamics Incorporated. Veterans of the Stan Winston Studio who had worked on productions such as The *Terminator*, *Invaders from Mars*, *Leviathan* and *Aliens*, Woodruff and Gillis had formed their own company in 1988 and had labored on low-budget efforts until getting their big break with *Tremors*. With their independent credentials now firmly established, the duo landed the *Alien 3* contract soon thereafter and promptly set up shop at Pinewood Studios in July 1990 — five years to the day after they had arrived as part of the Stan Winston contingent for *Aliens*. Unfortunately, because of the numerous production delays, changes in personnel and the evolving storyline, the *A.I* creature crew found itself all set up with nowhere to go. "We started working," recalled Woodruff, "but changes were being made to the story and we realized that we were over there too early. It got to the point where we were laboring for weeks over some dead bodies that were just going to be used in a reveal in the crashed EEV. There simply wasn't enough of our final work determined yet for the time to be spent productively."

While waiting to begin work on the alien itself, Woodruff and Gillis occupied themselves with smaller, but still vital effects, such as the Newt corpse. Because the little girl had supposedly been in hypersleep, what was needed was a lifecast of actress Carrie Henn — as she was in the previous film. "Obviously, she had changed a lot in five years," noted Woodruff, "so we couldn't just pop another lifecast off of her. We asked if the old casting was still around, and the production people at Pinewood took us out on the backlot to what looked like a big metal trash bin. We opened the door and were hit by this wave of odor from the resins and the silicone of five years ago. There were all

these molds just sitting out there — the life castings of Newt and Bishop, alien chest-bursters to use as reference. It was a real find." Using the five-year-old lifecast as reference, sculptor Gary Pollard fashioned a lifesize Newt corpse. "One of our crew, Dave Anderson, did a clay press off the Newt lifecast and then opened the eyes and put the face in a screaming kind of expression. Mitch Coughlin made most of the gelatin skins while Gino Acevedo handled the painting of Newt."

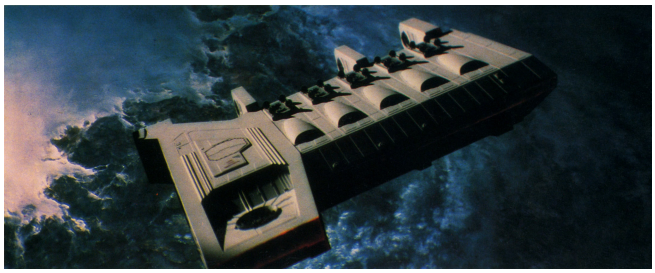
Despite the importance of such support effects, the alien monster remained the most critical aspect of *A.I*'s involvement in the show. Always a challenge, the presentation of the alien was to be especially difficult this time around since the director intended to hold the beast to closer scrutiny than ever before. "Philosophically, we went into the alien effects in a different way," said Fincher. "I didn't want them to be 'framed' effects shots, with everything else just clearing out of the way. To me, the alien wasn't just a monster, it was a character. So we decided that we were going to see the whole thing this time, as much as possible. We wanted the creature to walk on the ceilings and really sell the idea that this thing is a bug from outer space."

Designing the alien was a protracted process, primarily because the filmmakers initially intended to show an evolved version, rather than a repeat of what had been seen in the previous films. "Early on in the design process," explained Gillis, "we felt that we should take the alien in a different direction. The idea was that the creature would be constantly mutating to adapt to whatever the environment was, which gave us a reason to have an alien that was considerably different from the alien warrior in any of the other films. But, ultimately, Fincher decided that he wanted to remain basically with what we'd seen in the first film." Refinements were made, however, justified by the fact that this alien was to gestate in the body of a dog, rather than a human. "Supposedly the creature takes on characteristics of the host body that it gestates in. So this time, we wound up with an alien that was more of a quadruped and could run very fast on all fours, while still being able to stand up on two legs."



Among the many effects shots added late in postproduction was an establishing view of a Weyland Yutani spaceship — supposedly responding to an SOS from the besieged prison inmates, but actually on a mission to secure an alien specimen for biomilitary research. Budget constraints precluded the construction of a new ship, so the Sulaco featured in Aliens was refurbished and shot at Boss. When subsequent test screenings revealed audience confusion about the opening of the film, a shot of the Sulaco itself was deemed necessary to clarify it. The model was restored to its original state; but since only one side of it had ever been completed, the nameplate was reversed and the footage flopped to enable the ship to pass through frame from right to left.

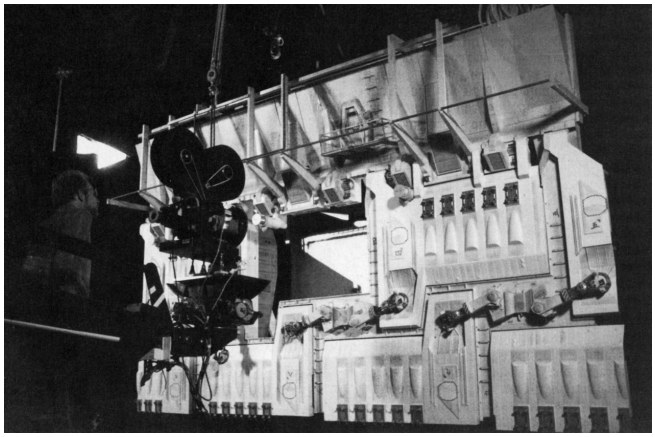
H.R. Giger the eccentric Swiss artist who had created the original alien, was brought onto the project to consult with Woodruff and Gillis during the design phase. “Even if we had had no contact with him,” Gillis insisted, “we still would have been working within the parameters that he set out. It’s his baby. Giger was acting as a concept artist, faxing loose sketches from Zurich. We used those drawings as references, picking out what we liked and embellishing it, always working directly with Fincher. We wanted to get closer to the look of the alien in Giger’s paintings, rather than what he had done on the suit in *Alien*. We tried to give it a more organic, sculptural feel and remain truer to his concept than even he had been. Some of the things he had done in the first film were completely serendipitous. The yellowness of the alien’s hands was just worn-off paint, and the face-hugger was unpainted raw latex — which looked great. So there were things that, by not being a monster maker, Giger accomplished that a monster maker might not have. Surprisingly, some of the things that we consider to be trademarks of the alien, Giger was not that wild about. For instance, he didn’t like what he called the ‘tailpipes’ on the back. He said he only added those to break up the human form, but he wasn’t satisfied with them.” Bowing to Giger’s aesthetic sense, Woodruff and Gillis deleted the offending appendages in their final concept.



An emergency on board the Sulaco results in the automatic jettisoning of the four Aliens survivors — still in hypersleep — in an emergency escape vehicle. Based on a concept by production designer Norman Reynolds, the EEV was built both full-size and in miniature. Boss executed a miniature shot of its plummeting toward the prison planet.

Once deployed from the Sulaco, the escape module drifts through space and then crashes into an ocean on Fiorina, a barren planet largely uninhabited except for inmates of the Fury 161 correctional work facility. For the approach, a sixth-scale EEV miniature was photographed against a bluescreen and then matted into a painting of the planet surface rendered by matte department supervisor Michele Moen.

Once designs were approved, the *A.I* team began producing the various representations of the alien's lifecycle. Among them was the face-hugger, a major player in both of the previous films. *A.I* developed an entirely new concept for a sequence in which a dead face-hugger was to be found, thus explaining Ripley's impregnation with a queen embryo. "We had designed and built what we called the 'super face-hugger,'" said Woodruff. "It was supposed to be a new strain of face-hugger, presumably one which would implant the seed of a queen. It was bigger than the regular face-hugger, had translucent webbing between the fingers, and was heavily armored with plates and spines. It was cast out of urethane and had an armature inside built to look like bones. It was articulated so that you could put it into any position, but it was never meant to be seen alive." Despite a considerable expenditure of effort, nothing of the super face-hugger survived to the final cut.



Another late assignment for the model shop was an interior section of the Sulaco needed for a scene of the module being launched into space. Camera operator David Hardberger prepares for the motion control shot.

Amalgamated Dynamics also built a more traditional face-hugger, first revealed climbing up a cryotube in the film's opening montage. After the crash of the EEV, that same face-hugger is observed in a confrontation with a dog that comes sniffing around the wreckage and promptly becomes the alien's host organism. "We used the same design as the original face-hugger," noted Woodruff, "but we had to splay it open a little bit because this one had much more movement in the front fingers and we needed extra room for the various mechanisms. We also sculpted new finger skins because the fingers were a little bit longer." Originally, the script called for the standard face-hugger to impregnate one of the oxen used to drag the EEV ashore. The creature's gestation in something other than a human host would justify, to some extent, the alterations in the anatomy and kinetic style of the final alien form.

The next phase of the alien's lifecycle was to be revealed bursting from the carcass of the mysteriously deceased ox. "We came up with what we called the 'bambi-burster,'" said Gillis. "It was kind of a lanky, four-legged chest-burster built as an articulated cable puppet." A nonarticulated ox carcass was also needed. Rather than build it themselves, Gillis and Woodruff elected to subcontract the project out to animal fabricators Val Jones, Alex Harwood and Monique Brown. The ox was equipped with *A.I*'s bambi-burster and shot, but not to Fincher's satisfaction. "To really do it right would have cost a couple hundred thousand dollars," Fincher admitted, "and we only had sixty thousand. It looked stupid. We put masonite filters on the lens and we still couldn't shoot the thing so that it looked right. The ox stuff just never played." Wanting to retain the idea of the alien gestating in an animal, Fincher decided to change the host from an ox to a dog. "I wanted something faster and more predatory than an ox. As a result, the final alien is not as elegant a creature as it was before, but it is more vicious. The change to a dog broke everybody's heart — because it had been done before in *The Thing* — but it helped when we got into the big chase

sequence at the end, because it gave us exciting POVs and explained the ravenous attack mode that the thing was in."

With the ox scrapped, Gillis and Woodruff were faced with creating a mechanized Rottweiler for a scene of the dog kicking and thrashing as the alien burst from its chest. *A.I* completed the assignment, promptly — but Fox officials questioned the need for the scene and declined to authorize the shoot. In fact, early screenings of the film had no chest-bursting sequence at all. "We previewed it to audiences," said Fincher, "and people would ask, 'Where did the alien come from?' So I said to Fox, 'Can I shoot the fucking dog now?'" With less than two months remaining before the release, the studio finally authorized a two-day shoot to fill in the narrative gap.

For a shot of the chest-burster scurrying away, Fincher proposed putting an alien costume on a small dog. "We looked at a bunch of lanky dogs and chose a whippet," recalled Gillis. "I made a little suit for the dog to wear, just using foam skins from the bambi-burster that I snipped and tucked and placed over a spandex leotard. She was really a great little dog, but Fincher decided that it wasn't working because she ran in a very straight-legged fashion whereas we wanted a more spiderlike movement. I think it could have worked in a quicker cut, but what he needed was a shot of it running all the way down a hallway and around a corner. We just pushed the idea a little further than it could be pushed. At one point, we wanted to get some huge dog, like an Irish wolfhound, and dress it up as the alien — just to get shots of it doing something weird that a person couldn't do — but after the whippet experience, we stopped considering it."

A workman cleaning an air shaft chances upon the infant alien's discarded skin — a piece assembled by the *A.I* team out of castings taken from the bambi-burster molds. Moments later, the next stage in the alien's growth cycle is revealed when a now adolescent alien spits acid into the man's face. "That alien was from a sculpture by Jose Fernandez," said Woodruff. "It was all done as a hand puppet, with other alien suit pieces dressed in around it to give it a weird look. The head was about sixteen to eighteen inches long. I puppeteered it for the shot, pointing it at the camera and using a video monitor to aim it right at the lens. As it comes into the light, it spits the acid out of its mouth. We had a hose inside, attached to a lever, so that we could shoot a spurt of this greenish-yellowish spit."

This first alien attack also demanded a challenging mechanical effect — the workman stumbles backwards, retreating from the spitting alien, then falls into a six-foot-diameter fan where he is chewed up like mincemeat. George Gibbs and his crew made a real fan blade, weighing approximately three hundred fifty pounds. "It was driven by a hydraulic motor," explained Gibbs, "at about a hundred fifty revolutions per minute. We also made up dummies for the sequence using a lifecast of the actor. The dummies were about an inch thick and we packed them with blood bags, plastic bits and stuff like that. There was a shaft angled down about thirty degrees. We had the dummy at the top, hanging from a wire, then we carried it down the wire and into the fan. David Fincher had asked us to do it as a model, but I thought it would be better full size. It was much more economical that way — and it worked fine." Although the script called for the victim's skull to jam the fan blades, the effect was not attempted. "That was a bit over the top. Besides, there's no way that a skull would have stopped a fan like that."

When the alien again reveals itself, it is as the full-grown warrior. One of the major concerns from the beginning had been the live-action alien warrior scenes — scenes that would include closeups and a great deal of interaction with the actors. Convinced that a mechanical creation of some sort would be both prohibitively time-consuming and artistically limiting, Fincher decided that a man in a suit was the only practical approach for the types of dynamic, interactive scenes he wanted to shoot. The suit was to be used carefully and specifically, so as not to reveal its human geometry, and the resulting footage was to be augmented with miniature rod puppet material accomplished by Boss Film in postproduction. With rod puppets, the insectlike moves Fincher envisioned — moves well beyond the range of any human performer — could be readily achieved.

Because the camera had never held long on the creatures in the fast-paced *Aliens*, that film had been able to make due with suits made of polyfoam pieces glued onto black leotards. To hold up to the scrutiny which Fincher intended, however, a more detailed suit had to be constructed. Tom Woodruff — a veteran rubber-suit performer — was elected to wear it. "It was a whole sculpted suit made out of spandex and foam rubber," Woodruff explained, "and we were really pushing it to the limit. We did a bodycast of me, shaved it down and sculpted over it so that the suit would have to stretch for me even to get into it. It was absolutely skintight to keep from wrinkling and buckling in strange ways. We had an amazingly fast and effective English sculptor named Chris Halls who did a large percentage of our sculpting, including the alien head and some of the suit. We made six suits altogether, some of them modified to fit a stuntman who ultimately was used in only one scene."

Among the subtle changes incorporated into the fully developed alien suit was a return to the translucent cranial dome featured in the original film. "Jim Cameron had gone for a more cockroach-looking head in *Aliens*," stated Gillis. "I think he must have felt that the translucent dome would have been impractical with all the stunts that needed to be done. But we always felt it would be worth the extra trouble. Fincher wanted more of a lip structure than had been seen before, too, so this alien had more human-looking lips over the top of its teeth. The jaw could open, the upper and lower lips could move independently to make it snarl, and adjustments could be made so that one side of the lips would curl up more than the other. It also had drool tubes so that we could pump thinned-down methyl-cellulose through it. All of this was in the head that Tom wore, controlled by cables."

In addition to the full body suit, Amalgamated Dynamics constructed a variety of alien tails for specific applications. "There was a cable-controlled tail that was not attached — it was just lined up to the suit. There was also a stunt tail, which was attached to the suit on a belt-type rig. That one we could marionette with wires or just leave to hang. One was a self-supporting tail which was attached to a rig that went around Tom's waist and also to some supports that went up his back and tied off on his chest. That was supported with a sheet of plastic inside so that it could stand up, and Tom would be able to thrash it around from side to side."

Gillis and Woodruff were also able to incorporate other nonhuman characteristics into the alien. "We made some mechanical hands with opposing thumbs that moved when Tom moved his own thumb," stated Gillis. "We also developed some triple-jointed leg extensions that Tom could walk on. They were fiberglass shells with struts and springs for the toes. We ended up not using them because they bulked up the legs a bit, and also because Tom would have needed a smooth runway to maneuver on and most of the sets were pretty cluttered. Essentially, the man in the suit was

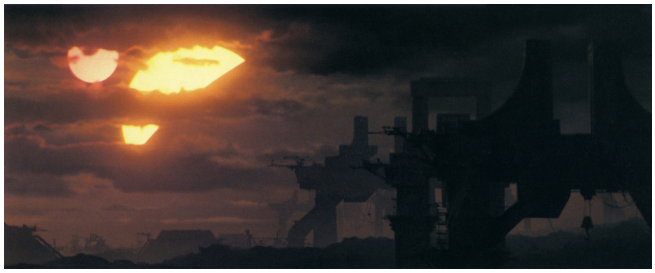
always intended to be shot no wider than waist up. Otherwise you would start seeing more of the waist and the legs, which were not quite as thin or dog-legged as the puppet. But we got all the detail a costume can provide."

While mindful of its limitations, Fincher was satisfied with the warrior suit. "It was beautifully sculpted and really well put together, but it was still very difficult to hide the human form inside. The suit gave itself away with certain movements. One of the brilliant things that Giger put in the design was the hammerhead — which helps to draw you to the face and not concentrate on much else. Still, there was only so much of just head and shoulders we could show before people would start to say, 'You're putting me on.'"

Woodruff donned the alien warrior suit and performed all of the required scenes during the live-action shoot. Effectively blind inside the eyeless headpiece, he was directed by fellow crew members via a walkie-talkie headset. "Tom is the best performer in suits that I know," emphasized Gillis. "Not only does he have amazing stamina for enduring the things; but by building them he knows what their limitations are. He knows how to move to get the best look out of them. When you have an actor in the suit, you have to have zippers and things in the appropriate areas for them to relieve themselves. Tom simply doesn't eat or drink when he's in the suit. He'll wear it for thirteen hours at a time without having to go to the bathroom. As a result, we can make the suits more form-fitting and seamless. Tom also has a vested interest in making the suit work; so if he has a complaint about something, he'll quietly come to me rather than shout it out to the production manager. Generally, I work with the director and then coordinate with Tom. Sometimes Fincher would say things like, 'Tell Tom not to make it look so much like a Barbie doll,' or, 'Tell him to up the scare factor twenty percent,' and I'd tell Tom what I thought he meant. Fincher was great. He had done stop-motion, so he'd been around monsters and knew aesthetics and dynamics."

The suit was used to good advantage in the first full-grown alien attack. Prison inmates Boggs, Rains and Golic are inspecting the *Fury* 161 toxic waste disposal area when the alien suddenly appears and, within seconds, slaughters two of the men. The survivor, Golic — a violent, but simple-minded convict — envisions the alien monster as a fiery dragon. Woodruff, wearing the suit, was placed on a platform with flame bars in front and in back of him. "Alec was lying down on the platform next to me — wrapped in a blanket to protect himself — working the mechanical tail. The cameras would roll and I would just go as long as I could before the heat became too intense. When I couldn't go any longer, I would stop and they would cut all the fire and then come in with squirt bottles and spray me down. The suit was actually steaming during the shots as the moisture boiled off the surface. It was almost too hot to touch."

In addition to such live-action scenes, the suit was also used to shoot reference footage for the rod puppet alien which would be filmed later at Boss. One shot slated for the puppet team was to reveal the alien in the background, darting from one tunnel to another, as the foreground characters talk, totally unaware. Woodruff was asked to don the suit and run across the track-and-cable-cluttered set, mimicking the furtive actions the puppet would be performing. The reference footage Boss received was of a less-than-menacing alien, clad in Reeboks, skipping clumsily across the dimly lit corridor and crashing painfully into a wall.



All aboard the escape vessel except Ripley, are killed in the crash. For an establishing shot of the work station exterior, set against a sky dominated by a neighboring planet and twin setting suns, a matte painting was rendered by Paul Lasaine.

The painting provided the background for a composite shot featuring the escape module being hauled ashore by a giant industrial crane. Modelmaker John Eaves applies a final coat of paint to the crane model prior to the miniature shoot on stage at Boss.

For closeup shots of the beast striking out at its victims, the full-size suit was supplemented with an animatronic attack head equipped with a projecting tongue driven by a pneumatic piston rigged by Paul Dunn. A simple press of a trigger would release the air piston and fire the tongue. One shot required that a human head explode with the force of the strike. "Mark Coulier detailed a fiberglass head with a canister inside it, hooked up to an air hose," said Gillis. "We packed that with blood, guts and chicken skin. Then we set a prescored plaster plug into the head, put wax over that and painted the whole thing so it was seamless. When the alien's tongue punched it, we fired the switch on the air hose and blew the brains out. It was pretty effective — as well as gruesome."

Lasaine details his painting of the Fury 161 industrial complex. Live-action ocean elements were projected into several of the matte shots. Many of the painted vistas were also enhanced with smoke and computer generated elements of wind-blown debris and dust.

Though Woodruff's performance in the alien suit provided a straightforward means to achieve quick cuts, Fincher's determination to reveal the monster's nonhuman form and movements necessitated extensive miniature puppet work. A one-third-scale puppet was designed by Gillis and Woodruff and constructed at Boss Film. "We've done miniature puppets before," said Gillis, "and we felt that it was important for continuity that we make the puppet — but that was impractical since we were stuck in England, so we did the next best thing. Since we had access to the director for approval, we finalized the design, Chris Halls sculpted it, we ran a mold and then we sent it to Boss with a painted model as reference. From that point on, it became their deal."

When three of the inmates die violently in quick succession, Ripley suspects an alien presence. Tom Woodruff and Alec Gillis orchestrated all of the on-set creature effects, including the 'super face-hugger' — a heavily armored, larger version of the alien face-hugger — which was conceived as providing a rationale for Ripley's eventual discovery that she is impregnated with an alien queen embryo. However, the super face-hugger was

Although Fincher had approved *A.I*'s original sculpture, alterations were made later at Boss. "We made a lot of changes after Fincher saw it on film and saw it moving," noted lead puppeteer Laine Liska. "The original design had a tendency to look a little stubby when seen from the front scuttling on all fours." Another casting provided five additional vertebrae to insert into the thorax, eliminating the foreshortening illusion. Also altered were the triple-jointed legs which were reduced by one joint because the trial puppet moved unnaturally and

proved difficult to operate. The final form of the legs appeared more like long, emaciated human limbs, yet still retained the exaggerated animal ankle joint. The arms and tail were also shortened.

ultimately cut from the film. Crew member Gary Pollard works on the sculpture.

Another deviation from previous outings was having the alien warrior gestate in the body of a dog. Woodruff and Gillis built a mechanical Rottweiler — equipped with a cable-controlled alien puppet — for the requisite chest-bursting scene.

For a shot of the newborn alien scurrying away from its now deceased host, Fincher had hoped to get an unusual effect using a small dog in an alien suit Tests with a whippet proved unsatisfactory, however, and the idea was abandoned.

The completed puppets measured approximately forty inches from nose to tail and stood about eighteen inches tall. An extendible tongue was installed but never used. The internal armature was kept simple and exceptionally loose. “For a lot of the joints, like the elbows and wrists, we used bicycle chain because it is a good strong joint with a fixed direction,” Liska explained. “Places like the shoulders and the hips were left loose so they could move in all directions. Electing not to do too much internal cabling gave us much more freedom, because we didn’t have to fight cables which might not hold the weight or might sometimes fight the rubber skins. Craig Talmy did the armature parts and the mechanisms.”

Once the puppet was built, the next consideration was how to convincingly animate it. Fincher envisioned scenes in which the alien was seen moving at great speeds and with distinctly nonhuman locomotion, revealing its long, thin limbs and waspish waist. Shooting and matting a puppet to meet these demands, so that it moved properly within the setting and with the correct interactive lighting on it, presented a complex problem. Fincher had shot the film with his camera almost constantly in motion during the action scenes. Consequently, the live-action plates into which the puppet would be composited might include any manner of camera moves and focus pulls. Moreover, the puppet element in the final composite was often required to radically change dimensions within the scene, making its seamless integration into the plate particularly difficult.

Boss met the challenge by developing an advanced motion control field recorder. “David’s ideas gave us the opportunity to do a lot of things that hadn’t really been done before,” Richard Edlund recalled. “It meant building a field recorder camera system to record fast tracking camera moves, pans, tilts and booms on the set, then come back and reshoot the same moves on the alien puppet to matte the creature into the shots. We would have to scale the motion control camera system’s dynamic directional moves and scale its nodal point position to match the miniature. The moves could be preprogrammed or altered if we chose. It had to be a quiet system and it had to be repeatable within a few thousandths of an inch over a long dolly track. We had a lot of requirements which aren’t normally met by this kind of equipment. We stuck our necks out and invested our own money to build it, but we’re in a business where we have to develop continually. Then we had to make sure it was up and running so that we could ship it to England.”

The system ultimately developed by Boss utilized a Fisher 9 dolly, modified to run with servo motors and electronics rather than hydraulics. “We used rubber wheels and avoided chains or gears — which take a lot of time to hook up and give you noise and chatter. Essentially, it appeared to the camera crew as just another familiar piece of equipment. The cameraman could ride the dolly, operate the dolly and the camera, and the grip could push the dolly. There was a through-the-

camera video station where the camera could be operated remotely. We used new model 65mm Panavision cameras which, for the first time, were equipped with an electronics interface for the motion control system. Aside from taking a little extra time to make sure the track was level and hooking up the wires to the video assist equipment, our motion control didn't hold up production very much at all. We recorded each take; and when David picked the take he wanted, that was the data file we ultimately used for the scale creature."

The same motion control dolly system was used to shoot the puppet alien. "We did have to change to a different camera, but we used the same lenses. The nodal points of the two cameras were not the same because that would have made everything unwieldy with the Panavision not balancing comfortably on the head. We knew how much the nodal point was off and could compensate, scaling that distance in scale to the creature. We would also alter the recorded focus to be in scale with the miniature. Even with all the difficulties associated with this kind of thing, our alien would lock absolutely perfectly into the shots, with pan, tilt, boom, whatever."

The original plate material from Pinewood was shot primarily at the standard twenty-four frames per second, with a few plates photographed at thirty frames per second to slightly exaggerate some of the action. Boss had to design the field recorder to automatically compensate for the different film rates that would be required for the miniature alien photography. Technical supervisor Phil Crescenzo was the lead designer on the system. "Initially, we were told that the field recorder files were going to be played back at four to six frames per second," Crescenzo noted, "and we would have to compensate for the lag errors in the servos. So we double-encoded, which I don't think has been done on any other field recorder. We took the encoder data from all the moving axes on the Fisher 9 dolly, but then we also recorded data coming back from the servos themselves. So we had data that represented the actual movement of the motors, not just the commands that went to the motors."

Motion control engineer Steve Kosakura spent many long hours operating and servicing the system. "There was only one shot in the principal photography where we really needed a quiet system," said Kosakura. "On most of the others there was so much noise from everything else that was happening on set that it wouldn't have made any difference. But it was almost unnerving that this system weighing close to a thousand pounds would move so quietly. The live-action motion control rig was used in a couple of different versions. One was the full rig, which was the full dolly with the pan-tilt head and the entire complement of remote devices. There were other setups in which the main dolly itself was not used and we would set up just the pan-tilt head for shots. This system traveled, and it took some abuse; but it all came through the long shoot."

Once the background plates were recorded and the grueling thirteen-week shoot in England ended, the Boss team returned to Los Angeles to begin shooting the one-third-scale puppet. Complicating the endeavor was the fact that David Fincher decided that the puppet should be shot at a higher frame rate than the background plates. The development team had to scramble to keep up with the shifting demands. "The software we chose to run the field recorder was developed by Kuper Controls," Crescenzo stated, "and Bill Thomas at Kuper pulled off some modifications that allowed us to shoot at any frame rate we wanted up to sixty frames per second. *Mark West* built the mechanics for the feature and I did the electronics. All we had to do was punch in a number and

the motion control system would play back the recorded move at whatever scale speed we needed to match that frame rate."

Articulating the alien puppet would have been accomplished by many effects houses using some variant of go-motion — which has become a standard alternative to stop-motion animation since the technique was pioneered on *Dragonslayer* in 1981. However, Boss took a different approach. "Go-motion has hideous complications," stated Edlund. "With fifty channels of motion control, slow and lugubrious work and extensive programming time, everything is very difficult and lacks flourish. Rather than go that route, Fincher wanted something more flexible — which, in the course of its development, became a high-tech rod puppet technique. Using that, our takes could range from one to forty-eight frames a second and encompass prerecorded camera moves. We could also motion control just a few puppet channels if we needed speed or the moving of large mass. With all these possible variables, it became a limitless type of system." The motion control rod puppet technique thus developed was dubbed 'mo-motion' by the crew.

As principal puppet animator for the project, Laine Liska had his doubts about the usefulness of the approach. "I was probably the hardest one to convince because of my stop-motion background. Richard was pretty insistent on the alien being a rod puppet; and the director seemed adamant that it not be stop-motion. But he also wanted to make sure that it didn't look like a man in a suit. If it had been up to him, it would have been a fully articulated robot — and we'd still be making it."

Rod connector points were installed on either side of the puppet's head, at three locations on the rib cage and at a single point on the hip near the root of the tail. Slender rods were attached to each foot and hand, and two wands were used to manipulate the tail. The number and location of the rods were dictated by the action required and the orientation of the puppet relative to the camera. Typically, Liska would control the head and the torso, another puppeteer would operate the arms, while others still would move the legs and tail. Crew members Craig Talmy, Douglas Miller, Brett White, William Hedge and John Warren all assisted in puppeteering the creature.

Keeping with the original mo-motion concept, the trunk of the puppet was attached to a motion control mover for the gross center-of-mass motion and to keep the figure at the proper location in the frame. Although retained for many of the scenes, the effects people quickly found the arrangement a hindrance to achieving the rapid moves and fluidity they sought. "The alien tended to move like a bunny rabbit," Liska revealed, "and we couldn't seem to get past that because the computer kept smoothing things out. David was going for movements that might resemble something familiar, but not anything in particular. We were first told to make it run like a cougar. We looked at cougar footage; and when we did our original tests, we pretty much got that. But that ended up not being what he wanted. Other characters were suggested, like a spider or something else that was gangly. David was going for the oddest configuration that we could get. We found that rods and manpower helped it to look as erratic as possible."

The puppeteering rods were painted to match the color of the creature so that, if they crossed over the figure during the shot, they would not be detected after the rest of the rod had been removed through rotoscoping. One end of each rod was fixed to a block with handles on it. It then became a matter of the puppeteers moving the blocks on a flat reference plane. The elevated puppet — shot against bluescreen — would appear to be moving on a flat surface, and yet the open area around the

figure would limit the need for roto work. For scenes of the creature scrambling on the ceiling, the puppet actually had to be animated upside down since the motion control system did not allow for flipping the motion files — a cinematic trick which would have eliminated the need for the inverted stage work.

Fincher was particularly concerned that the puppet appear to be actually interacting with the floors, ceiling and walls within the live-action plates. "Everyone was afraid of floating hands and feet," effects art director David Jones noted. "Early on, we tried using clear plexiglass surfaces so the alien's appendages and joints could actually react to something, and yet the bluescreen would still be visible all around. Of course, we ended up with the problem of the alien and the stage lights reflecting in the clear plexi. Some plex was set up at an angle to the bluescreen so that the angle of incidence made it reflect only the bluescreen light. We also experimented with blue plexiglass so that even if we put white or amber light onto the alien we could backlight the plex panels and still be able to pull the matte."

Seeking information about the likelihood of an alien presence on the planet Ripley reactivates the remains of the Bishop android — tossed into a garbage heap after its discovery aboard the wrecked EEV. Two versions of the android were fashioned by the Amalgamated Dynamics team. The first was a nonarticulated head and torso used for shots aboard the recovered craft Dave Anderson —

who rendered the initial sculpture using a lifecast of actor Lance Henriksen — finalizes the nonarticulated Bishop form.

A fully-articulated version of the head was built for a lengthy dialogue scene between Ripley and the reactivated android. After disappointing results with cable and radio control mechanisms, Woodruff and Gillis finally achieved convincing lip-sync dialogue using a real-time computer animation system developed by Gilderfluke and Company.

Confirming her worst fears, Ripley submits to a CAT-scan which reveals a queen embryo growing within her abdominal cavity. Model photography was digitally processed by Video Image Associates to achieve the effect.

Although some of this experimentation proved successful, it was found that the small nuances in movement thus produced did not read significantly on film. "I'm used to stop-motion where I have control over everything and it is usually done in one take," Liska said. "For this, we would do twenty takes on video before we ever rolled any film. Occasionally we would have a real-time take on video that looked good; but then we'd be shooting on film at forty-eight frames per second, and we'd have to wiggle the puppet so fast that there was no way to maintain any mental record of what we had just done. When we got down to six and twelve frames a second, then we could achieve particular moves with very little rehearsal. But that lower frame rate had a slightly less fluid look that David didn't like, although once in a while he had to live with it. We also had very little success shooting the character straight on. Those were the shots where we had eighty or one hundred takes. It was a more interesting angle if we were at a three-quarters view or looking at it from the back."

Other problems the animators encountered were due to the intense lighting that had to be used to ensure proper depth of field. The heat on stage proved horribly uncomfortable. Even the puppet suffered the effects — occasionally it would begin to smoke, and the plastic head dome cracked

For the CAT-scan sequence, Woodruff and Gillis provided anatomical sculptures representing the interior and exterior of Ripley's torso. Video Image photographed each of the sculptures separately on a motion control system, scanned the resulting imagery into a computer and then digitally processed the rotating elements so that multiple layers would be visible in the final graphics element.

While the queen embryo develops within Ripley's body, the alien warrior grows to maturity in the Fury 161 air

repeatedly. Also, despite the use of Boss' largest bluescreen, the figure would sometimes move beyond the edges of the process screen. Edlund proposed that a smaller screen be rigged so that it could be pushed along relative to the puppet. As the camera and dolly rolled along performing their preprogrammed moves, as many as six puppeteers would be crowded on a platform, furiously moving the little figure as they were being pushed along a track, while a bluescreen was being moved behind on an adjacent track — all amongst a forest of lights and cables.

ventilation system. Although most of the live-action scenes were performed by Tom Woodruff in a series of suits made specifically for him, additional alien suits were constructed to be worn by stuntman Val Musetti. Woodruff and Gillis prepare Musetti for a scene in which the alien bursts through a ceiling panel in the mess hall and snatches the prison superintendent.

In one of the cramped corridor sets, creature crew members David Elsey, Mitch Coughlin and Alec Gillis outfit Woodruff in the skintight alien costume. A veteran creature performer, Woodruff endured the suit for up to thirteen hours at a time during the arduous shoot.

In spite of such difficulties, the miniature shoot was a success. "There was something really interesting, a more animal feeling, about bringing five intelligences to bear on a single puppet," said Fincher. "It gave it sort of an insect quality, like the way a tarantula walks without any sort of order to its feet. There were certain things I wanted in the movement that we never nailed perfectly — and in some ways, mo-motion hindered what I wanted. But in other ways, we got fluky things that looked cooler than anything we could have imagined. We found that if we got the head and tail right, then it didn't really matter what the legs were doing. The tail was what made it look organic and the head was what made it look like the alien. When those two things were in sync, that was usually when we had a take that we liked."

Contributing to the success of the shoot was yet another Boss innovation that provided a means of previewing composites on stage. A system was developed that allowed a pass on the miniature against a bluescreen to be recorded via a video tap on the camera and electronically composited with the plate, already converted to video and stored on a laserdisc. "We believe the system was the first of its kind," Edlund noted. "Because the takes might be at one frame a second or at forty-eight frames a second, we had to convert that frame rate to combine it with the live-action scene at twenty-four frames a second. If we were shooting one frame a second, then we would extract frames and do frame averaging and we would get a kind of blur. But when we got past seven-and-a-half frames a second, then we had to extract fields. Not only the frame-accurate sync, but also the angle of the shutter on the camera had to be the same; otherwise, we'd have slop and the alien would appear to be sliding on the floor. The laserdisc video comp gave us the ability to tell whether the creature was interacting with the actors or bumping into things. We had to know right away, because we didn't have the luxury of shooting the scene and leaving the setup until after dailies. There were a lot of shots to do and we had to be able to move on with impunity, knowing we had the take."

Phil Crescenzo designed the laserdisc compositing system. "I had to select a combination of equipment for the job. I looked over what was available in the industry, but basically there was nothing to help me. It was frustrating, because I was trying to do something before the industry was ready and I had to go the long way around. I chose a PC platform and combined it with a laserdisc and some other electronics, some of which were designed in-house. When I started designing the system, my target was seven-and-a-half frames per second, which the Sony laserdisc could just

barely do. But we wound up shooting at twenty frames per second, or higher. So we had to come up with a scheme that encoded actual camera frames and then removed replicated frames. With the help of Sony and the people who make the frame-grabbing targeting board, we were able to sync to the film camera all the way up to forty-eight frames per second and provide frame-for-frame accuracy that could then be combined with the plate."

The background plates had to be resized to fit the video tap images and then transferred to videotape for later transfer to disc. Video Image Associates performed the task. "Some of the plates had torches and other things in the shots that had to be reproduced on the alien itself," Crescenzo stated. "I wrote a piece of code we called 'flicker processing' that allowed us to follow a particular area in the plate and create a table of its relative intensity per frame. Steve Kosakura then put that data into the motion control system to run light gags and replicate the flicker and whatever else directly on the puppet. Doug Calli operated the laserdisc system and contributed a lot of input to make things happen more quickly."

Rick Fichter was on stage during both the field work in England, and the puppet shoot in Los Angeles. "Without the laserdisc system," Fichter noted, "you would have to make your best guess at a take and then weed through them later. The tendency might be for a director to overshoot in order to make sure that he got it right. The laserdisc allowed us to zero in on a specific action and a specific take without having to go through the usual black-and-white tests, wait for the dailies and then go to optical before we could see the results. We could tell quickly whether or not everything was locked into the plate. We also used the system for elemental shooting wherever we needed a quick turnaround — for steam and smoke and fire elements, mostly. It really sped up the whole editorial process. The laserdisc compositing gave us information in a small fraction of the time it would normally have taken."

Donna Langston, visual effects line producer at Boss, noted that the approach also allowed for an expansion of the director's role in the postproduction effects work. "Usually an effects company will work on the shots and then send them over to the director to get his comments. But David is very familiar with all aspects of effects and can speak our language. It is really a love of his. So for him, the puppet work became much like a live-action shoot, with the puppeteers being his actors and the video system giving immediate feedback."

Even with accurate positioning of the creature in the background plates, the Boss Film optical technicians still had their work cut out for them when all of the elements reached their department. "It was difficult because we were locked in," said optical chief Michael Sweeney. "Some very articulate roto and some careful work in optical was required to ensure that the puppet fit the scene. We had to use different techniques to enhance the blur of the alien, as well. I would have gladly accepted overcranking so that there wouldn't have been so much blur, but the director wanted to see something that was blurring right along. We ended up using a technique involving a combination of continuous tone matting and normal high-con-type matting." Fincher was still not satisfied, and came up with the idea of adding optical shake to the scenes of the monster speeding by to enhance the sense of action. Sweeney was able to comply. "All of our effects are shot 65mm and we have, as far as I know, the only 65mm zoom aerial printer — or ZAP — which has follow focus, zoom, motion control and exposure compensation all built into the program. We did some tests; the director was able to choose what he liked; and we introduced shake into the shots after

the fact. Later, when we went to do the reductions to anamorphic format on our sister 35mm camera, we just matched the shake moves that we created in our mattes."

Continuous adjustments and late production changes created mounting work for the harassed optical department. All of the original alien shots had been completed, in fact, when Fincher asked for some changes. "He wanted to change the size on some," said Sweeney, "add elements to certain shots, drop other shots, put shots on hold that they had brought back and reinsert sequences that had been deleted. You always want to look at a scene as if it's simply the alien over a background, for example, but that's just where it starts. Just shooting the alien against a bluescreen involves a number of color separations and cover mattes. We also added in shadows, debris, smoke, fire and animation lights. I would guess the most we had to deal with in any one shot was twenty-two to twenty-five elements."

Some of the pressure on the optical department was relieved by computer generated imagery. Although the Boss Film computer graphics department had been on the scene for less than a year, the hefty investment in people and equipment had already been offset by significant contributions to commercials and film projects. The department — headed by digital effects supervisor Jim Rygiel — was gearing up to full potential when the *Alien 3* project came along. Nevertheless, the team's input, though subtle, proved indispensable. One of the major contributions was providing shadows for the alien puppet. Without the benefit of computer graphics, the job would have demanded a laborious rotoscoping effort. "We took the bluescreen puppet element and the background plate and scanned them into the system," Rygiel explained. "Then, by making a matte of the bluescreen element, we were able to create the shadow simply by bending the matte over as the light source would suggest for a shadow. By using the background, we were able to distort the shadow, bending it to actually fit over pipes and along walls, whatever. So the shadow would sync up one-to-one with whatever the alien was doing."

Mattes were also enhanced with computer graphics. "In many cases, the director wanted the creature to be really blurry as it was running, to get a feel of action. When you do that on bluescreen, the faster you go the harder it is to pull the matte — it's a threshold kind of thing. Our threshold is a lot finer. In a couple of the more difficult scenes, we scanned the bluescreen element in and were able to pull a softer blur. In other cases, parts of the elements would drop out completely. For example, with a moving arm, you might be able to see it in frame one and frame three, but in frame two it would be gone. We were able to replace some of those elements."

The creature itself was not the only challenge faced by the various effects providers. After the first attack and Golic's account of a fiery dragon, Ripley suspects that she has unwittingly unleashed an alien on the remote work station. To confirm her suspicions, she seeks out the remains of the android Bishop — unceremoniously dumped into a garbage heap. Finding the android severely damaged, but still somewhat functional, Ripley reactivates him in hopes of retrieving information about the most recent alien manifestation.

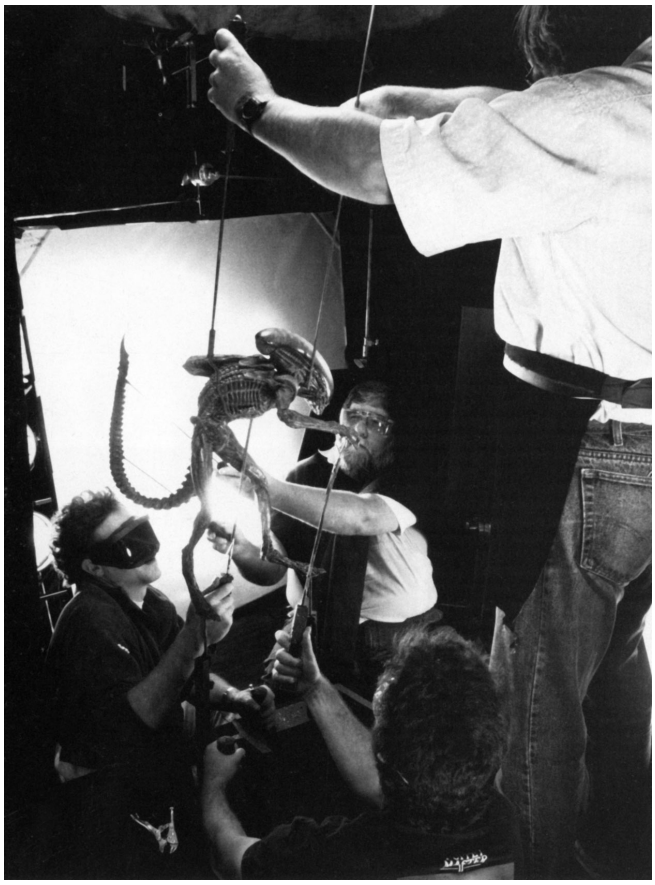
Without weapons, Ripley and the prison inmates use fire to drive the alien into a secure toxic waste disposal vault. Perceiving the beast as a mystical fiery dragon, however, one of the prisoners releases the creature from its cell and the killing spree resumes. Woodruff — essentially blind in the alien headpiece — waits patiently while one of the physical effects crew members attends to the flame bars used in the sequence.

The alien studies one of its fallen victims. Though convincing in closeup, wider shots of the alien suit revealed its human proportions and were thus generally avoided. In addition to the full-body costume, Woodruff and Gillis constructed a closeup attack head with articulated lips and extending tongue.

The task of creating a talking Bishop head — which fell to Woodruff and Gillis — was started at Pinewood, but largely completed back in Los Angeles. "The initial sculpture was done by Dave Anderson," said Woodruff. "Last time around, on *Aliens*, we had a lifecast of Lance Henriksen made with his eyes and mouth open for when the android is torn in half. Dave did a clay press of the head from the old casting and used photos of Lance for a new sculpture. He did a great job, capturing all the detail. We actually had to do the character in two stages. One stage was for his discovery in the EEV where he is basically shown only from the waist up with both arms over his head. Then, out of that, Dave did another clay pour and sculpted the version which Ripley finds in the rubbish pile, which was just his head, his right arm and part of his shoulder."

For shots depicting the creature's full form, a rod puppet was photographed at Boss and composited into live-action background plates with additional fire elements.

Because the head that Ripley finds in the garbage heap was nonfunctional, *A.I* made the stunt version out of gelatin. "We wanted a translucent quality to the flesh," Woodruff explained. "We told them that the only limitation was that it couldn't get wet. It was supposed to be raining in the garbage dump where Bishop is found, but Fincher assured us that it would only be a light sprinkle. Of course, they had torrents of water coming down all the time. They shot all the stuff with Ripley picking this thing up and stuffing it into a cloth bag. Then they wanted to come back and shoot the closeup. At that point, it was pretty much trashed and we had to go back and rebuild a prop piece that they could carry around for the rest of the shooting. Obviously, gelatin was not the material to be chosen for that kind of an environment."



Fincher envisioned fast and predatory movements for the puppet alien. Rather than using go-motion — a popular approach for puppet photography in recent years — Richard Edlund elected to animate the creature utilizing a combination of motion control and advanced rod puppetry. While the tracking moves of the puppet were motion controlled, character articulations were achieved manually via rods connected to the limbs and body. Lead animator

Returning to her room with the remains, Ripley reactivates what is left of the android. The reanimated Bishop presented Woodruff and Gillis with a singular challenge. "We jumped at the opportunity to do an articulated head," said Gillis. "The way it was going to be shot, we knew it couldn't be any kind of makeup prosthetic or a guy with his body draped off in black. Essentially all he is is a head and an arm, but he is still a character. Building a completely mechanical character was

very exciting. In the film, there are profile shots of this thing talking where the screen is filled from his chin to just above his brows. It's amazing the detail that shows up and the facial articulation that was achieved with remote control. As far as we know, there has never been a performance strictly between an actor and an articulated head like this."

Laine Liska oversaw the puppeteering effort, which generally required four or five operators per shot.

While still in England, *A.I* made a first stab at the sequence using a puppet operated via cables and radio control. Neither Gillis nor Woodruff was satisfied with the results. "The puppet wasn't moving realistically enough and it wasn't capable of doing the lip-syncing we wanted to do," Woodruff revealed. "Consequently, the director was forced into staging the scene so that it was shot basically over the top of the head. It was all focused on Sigourney and lit so that it downplayed the puppet, except for some wide shots where the puppet was in view. After we got through that day of shooting, we tore the whole thing down and had it rebuilt just as a cable puppet, figuring that that way we'd at least get more direct control than we'd had with the combined cable and radio control model."

Tests with the second version were still not satisfactory and the puppet was rebuilt yet again. Articulation problems were finally surmounted by employing a device produced by Gilderfluke and Company. Founded by Doug Mobley, Gilderfluke had developed a real-time computer animation system capable of providing motion control commands to any manner of moving apparatus. The system had already been used with great success by Rick Baker for the brain gremlin in *Gremlins* II and by Kevin Yagher for the crypt keeper host of Tales from the Crypt. By recording puppet movements to a SMPTE time code, the movement could be reproduced at any speed — and supplemental movements could be superimposed in a contiguous manner. The system's ability to alter the speed of the puppet movements to synchronize with the dialogue, edit the movements and even 'skew' the puppeteers' inputs to allow for human reaction time made the system ideally suited to the *Alien 3* application. "We had wanted to try the Gilderfluke system for years," noted Gillis, "and had never had the chance. So this was a great opportunity to use it — but we were stuck over in England."

Upon their return to Los Angeles, Woodruff and Gillis invested their own money into the system and were able to reshoot the Bishop head scene in November 1990. Dave Nelson supervised the mechanics for the shoot and Brock Winkless programmed the lip movement for the dialogue. "Part of the challenge was to make it not look like the *Terminator*," said Gillis. "It was a standard robot thing, with his face half gone. It looks like some kind of organic material, but we kept the whitish motif. One of his eyes is kind of clouded as if it has hemorrhaged, and he's got the white android blood oozing out of his head. It was a vacuformed shell and his skull pieces were acrylic. There was also an air hose to blow a little spit out of the mouth."

"We used urethane materials for the Bishop skin to get some translucence and an extra fleshy quality to it," Woodruff elaborated. "We're always pushing materials, trying to get away from just foam latex, or rubber and polyfoam — getting into things that read more like flesh. For Bishop we used Skinflex III. Not only is it translucent, but where foam latex will kind of crinkle up at a point of movement, Skinflex has the ability to compress upon itself like skin. So it's much more natural looking. Yuri Everson really came through as far as running up these skins. The manufacturer recommends that you not plasticize this stuff higher than thirty-five percent. We needed much

more flexible skins, so we had Yuri push it all the way to ninety percent. He was able to get the material to run and cure successfully." Gino Acevedo did the cosmetic work, painstakingly applying translucent washes until the desired effect was achieved.

From Bishop, Ripley learns that there is indeed an alien in their midst and that the Weyland Yutani Company is still intent upon bringing it back to earth — no matter how costly the casualties. Stuck on the remote planet without weapons, Ripley and the inmates devise a scheme to drive the creature through the air ventilation system with fire and trap it inside an inpenetrable toxic waste disposal vault. In the story, the fires were supposedly produced by a flammable gel which the men paint on the interior of the air shafts. The physical effects unit had to use more conventional means. "For the fire we used petroleum gas," said Geoge Gibbs, "in gas flamethrowers which worked from solenoid valves, although they were sometimes operated manually. Occasionally we used petrolene bursters. It was all done on full-size sets." The alien attack scenes in the sequence allowed for a variety of other mechanical effects. "We made a hydraulic ram tongue for a gag in which the alien thrusts his tongue through a window in a door and into a guy's head. We also did the alien's green acid blood eating into metal. The acetone-onto-styrofoam effect has been done a lot before and we wanted something different. So we tried caustic soda, which burned into sheet aluminum very nicely." The Gibbs team also provided a generous amount of blood and a number of bodies to represent the alien's charred, dismembered and otherwise mutilated victims.

Led by Ripley, the inmates eventually succeed in trapping the alien. Before it is safely locked away, however, it comes to within striking range of Ripley and, amazingly, leaves her unharmed. Immediately suspicious, Ripley submits herself to a CAT-scan which reveals an alien queen embryo growing within her. Like most of the film's alien effects, the embryo went through several conceptual changes. "It started off as just a creature embryo," Gillis commented, "and then it was later decided to make it a queen embryo. So we had to go back and take a copy of our sculpture and make an appliance to give it the queen carapace, the hood. It didn't have the tiny arms like the adult queen; but we thought, what the hell, maybe she grows those later."

The change from warrior to queen embryo had a far-reaching impact on the ever-fluid storyline. Borrowing from a sequence which had been cut from the original *Alien*, Fincher early on intended to feature the discovery of partially-devoured victims being transformed into alien spores through a metamorphical cocooning process. This would have provided some rationale for the creature's disturbingly pseudo-intelligent malevolence. Fincher's decision to incorporate the James Cameron concept of an egg-laying matriarch, however, rendered the cocoons antithetical. "They were begun and then killed halfway through," Woodruff lamented. "We were going to end up making about twenty of these cocoons, all vacuformed and stapled up. We started on two, and then the plug was pulled because Fincher's idea was that the creature simply kills to eat. Actually we did finish one off for Fincher because he liked it so much. He had it on the set with him and would occasionally climb into it for inspiration. He called it his 'thinking shell.'"

In addition to the queen embryo, sculptures representing the internal structure of Ripley's abdominal cavity were prepared by Jeremy Hunt, an English member of the crew, for use in the CAT-scan sequence. Upon completion, the anatomical fabrications were turned over to Video Image Associates for photography and image processing. "A.*I* provided us with a full-scale torso in four layers," recalled Richard Hollander. "These were a top skin, muscles, ligaments, bones, and then the

internal layer showing the intestines, the heart and that sort of stuff. They were made so that they could be placed as registered layers, each positioned, then pulled out and another put in for the next layer. *A.I* also made a larger-than-life model of the area where the alien is embedded in the chest cavity. For the chest cavity portion of both, there was a rod puppet alien fetus and human heart which *A.I* operated. There was a little air-actuated heart in the alien, too. An opening in the rear of the larger-than-life model was used to backlight and see through the innards and the alien, which were somewhat transparent."

Video Image shot the models on a motion control system, moving them to make the layers appear as if they were being rotated around the spinal axis. "It gave a sort of 3-D, x-ray look, with everything moving. We put in a layer, photographed it with the motion control, replaced it with another layer, did the same move on that and so on. So we ended up with multiple elements, one for each layer. Then we scanned them into the computer, colorized them and digitally comped them so that more than one layer was visible in the final graphic element. Although the layers were all painted, we electronically stripped them and added our own monochromatic, greenish color." Ripley's impregnation with the queen embryo was originally meant to be revealed during the montage sequence at the opening of the film. *A.I* had built a puppet which showed the embryonic organism traveling through a face-hugger tubule into Ripley's throat. The sequence, eventually cut from the film, was also enhanced by Video Image.

One of the major action sequences of the film — the 'bait and chase' sequence — results when the crazed Golic releases the alien from the toxic waste storage vault. Without other options, Ripley and the remaining prisoners use themselves as bait to draw the alien to its death. The climax of the film occurs in the station foundry when the alien is trapped with Ripley in a giant lead mold used to cast radiation shields. The set featured a huge furnace for melting the lead and an overhead crane for carrying the molten metal from the furnace and dumping it into the mold. Although the creature is eventually deluged in molten lead, its insidious resiliency and adaptable metabolism allow it to survive. It is killed only after Ripley activates a sprinkler system and the cold water striking the superheated, lead-covered xenomorph causes the creature to explode.

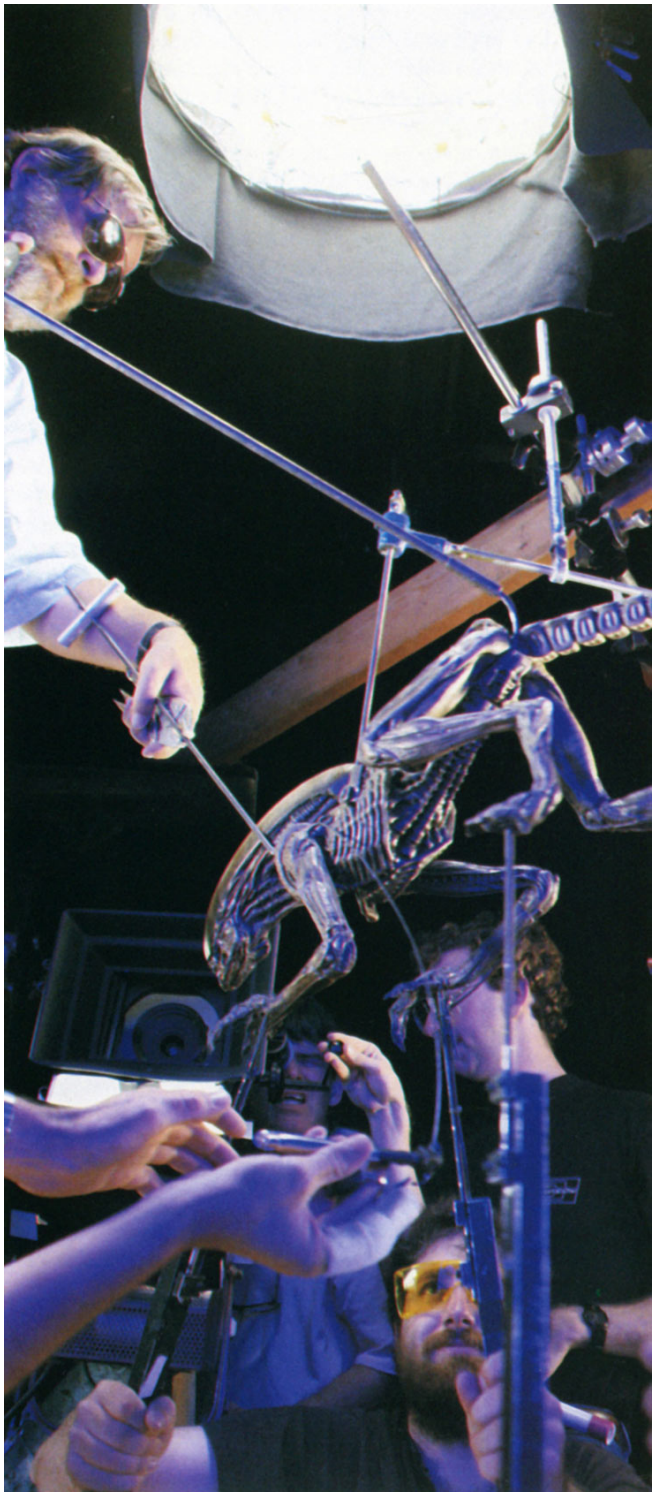
The foundry set was designed by Norman Reynolds and built on the giant 007 stage at Pinewood, with Gibbs and his crew providing the required working mechanisms. "The most difficult thing about the sequence was the crane," Gibbs stated. "The gantry was about forty-five feet long and rotated hydraulically. The radius was such that we had to have solid wheels at the outside edge; and because it was so big, the neoprene on the wheels had to be machined off at an angle so that it would turn with ease on the steel plate in the floor. We simulated the furnace fire with lighting beneath a big silk backing and with dry ice vapor. Another problem was how to drop over a thousand gallons of this molten lead out in one hit, with the steam and everything. Typically, we would use a tipping dump tank. But in this case, we had to hide the dump tanks inside the gantry. We made three tanks, each holding about three hundred gallons. Then, instead of tipping them, we built in hydraulic trapdoors. On cue, the trapdoors opened and we dumped the molten lead."

The lead was actually aluminum paste thickened with methocel. "It took a lot of experimenting to achieve the effect because there are many types of aluminum, such as powder form. However, when aluminum powder is mixed with water for long periods of time it can start giving off hydrogen gas. With all of the fire effects and explosions we were going to be doing, we had to go to great lengths

to be safe. Finally, we found a paste in which all of the particles of the powder were coated with a chemical which makes the aluminum inert so that when mixed there is no way it can explode or catch fire. When the lead mixture was dumped into the mold, it was actually at room temperature. But I had steam valves fixed in above so that the steam was drawn down with the lead and made it look white-hot. We had steam everywhere — we used steam generators and had receivers with valves on each set."

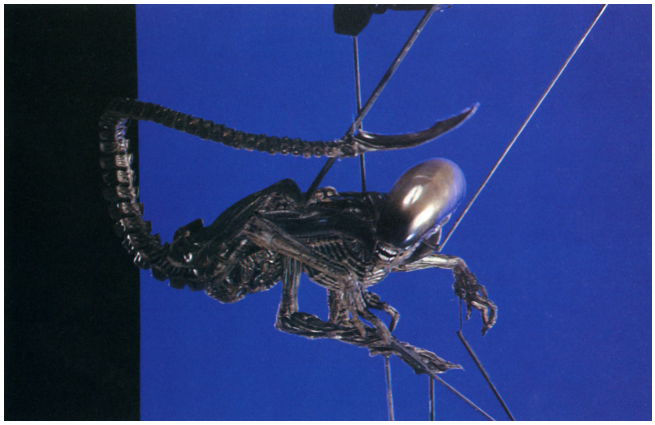
A pair of two-thousand-gallon tanks supplied the sprinkler system. "The tanks contained submersible pumps that could pump up to eight hundred gallons per minute through six-inch pipes into the two water jets on the gantry. We were lucky in terms of drainage because the set was built in the tank on the Bond stage." Gibbs created the illusion of the alien exploding using a hollow alien form. "It was molded out of a sort of flexible polyurethane and it had a skin that was about three-quarters-of-an-inch thick. We packed it with green blood and bits and pieces, and laced up the body with light grain primer cord and then set it off." Though the various effects were well-executed, time was running short for the England shoot and, ultimately, much of the lead mold sequence had to be reconstructed and reshot on stage in Los Angeles.

The demise of the beast in molten lead had been elaborately — and expensively — prepared for when *Terminator 2*: *Judgment Day* was released in July 1991. Because that film — the latest by *Aliens* director James Cameron — also climaxed in a vat of molten metal, the *Alien 3* production team was instantly concerned that their film would be considered doubly derivative. "We were about two weeks into shooting when somebody learned about the similarity," Fincher recalled. "It was a legitimate concern, but we were just too far into it to change at that point. Plus we felt that the different mentalities brought to the same effect would yield different enough results." Ultimately, no radical changes were made to the story.



Visual effects cosupervisor Rick Fichter lines up a shot as the puppeteers rehearse a move. Though capable of standing erect the alien often employed a four-legged gait derivative of its canine host organism.

As originally scripted, the alien's death was to be followed by the violent birth of the infant queen from within Ripley. Clutching and tearing at the small beast, Ripley was to reposition the crane and allow herself to fall into the furnace — thus ending her own life and preventing the continuation of the alien species. Gillis and Woodruff prepared a chest-burster that — unlike the ones used in the two previous films — would attach directly to Sigourney Weaver's chest without the need for a false torso which would have been logistically prohibitive given the setting. "We had a whole effect built where Ripley's rib cage was spreading and then the queen bursts out. The articulated rod puppet had moving arms and snapping jaws. But the director felt that it had been well established in the first two films that when a person had a chest-burster come out, they die instantly. Ripley's falling off the precipice would then be an involuntary thing instead of a heroic act."



Because the puppet had a tendency to move beyond the edges of Boss' largest bluescreen during some of the motion control track moves, Richard Edlund suggested mounting a small bluescreen behind the puppet and tracking it in sync with the motion control dolly — thus ensuring a constant blue backing.

A video tap off the camera — coupled with an on-stage laserdisc compositing system — enabled the effects crew to determine immediately if the puppet was properly articulated and would interact convincingly with characters and set pieces in the live-action background plates. The puppet alien advances on Ripley in the station infirmary.

"The chest-burster in the first movie was great," Fincher elaborated, "because it had been grounded in reality. There was a loss of control there that was really frightening. And the victim was lying on a table which gave them the ability to do the effect. But we had Ripley standing forty feet up in the air with nothing but steam around her for one hundred seventy-five feet. How were we going to put this thing on so she didn't look like Lou Costello? Sigourney's a very statuesque woman; and to hang all this stuff on her, as well concealed as it was, just made her look porky all of a sudden. It was inelegant all around." By way of compromise, Fincher shot a stigmata effect, with blood blossoming across Ripley's shirt before she falls. But that, too, was eventually cut. "Everybody felt it was too religious; and to be perfectly honest, I thought it was vulgar. If she gets ripped apart before she falls into the fire, that's not sacrifice, that's janitorial service. To knowingly step into the void carrying this thing within her seemed to me to be more regal."

One of the advantages of the rod puppet approach was that the alien could be made to perform virtually any of the bizarre, insectlike maneuvers favored by the director — even climbing down walls and across ceilings. Special care was taken to ensure that the creature's hands and feet always appeared as though they were making contact with the set surfaces in the composite.

Although not extensive, most of the film's model work was completed during postproduction at Boss. Late in the schedule, the model shop was tasked with building a tabletop miniature depicting two giant furnaces atop the main Fury 161 complex. Because of limited funding, model shop supervisor David Jones opted to build the miniature quickly and inexpensively out of foamcore and plastic.

Despite the seemingly endless difficulties, principal photography in England ended as scheduled. However, the film was far from completed. Nearly a year of postproduction ensued, the first three months of which were spent with Fincher directing second unit shoots on soundstages at Twentieth Century Fox. "It was a matter of them wanting to put together some kind of rough cut and determine where and how much monster stuff was still needed to cover the story," Woodruff explained. "The plan was to bring back set pieces or rebuild parts of them that we needed. So we had everything packed into crates and shipped to the States — and it sat in our shop from June until December of 1991 when we finally spent a few weeks shooting at Fox."

Since much of the postproduction work involved challenging floor effects, Fox brought on Al Di Sarro to act as the special effects supervisor for the Los Angeles shoot. Di Sarro had served the studio well in the past, notably on *Die Hard* and its sequel. Much of his *Alien 3* work involved recreating the lead mold sets and riggings for the alien's death which had first been attempted in England. "We constructed two large dump tanks capable of holding about four thousand gallons of lead each," Di Sarro recalled. "The rear tank — behind the alien — filled as much of the frame as we could with pouring lead. The forward tank — over the alien — was dumped at a slower rate so as

not to drive Tom Woodruff, who was performing in the alien suit, to the floor. The lead was then recirculated for multiple takes. All together, we must have dumped twenty thousand gallons of lead on Tom. Obviously, we had to come up with a formula that was nontoxic and biodegradable. We used black mica and silver pigment from the makeup industry for color, and mixed in methocel as a thickening agent. The pouring lead was a thinner consistency than what we used to dress around the set. There were also two twenty-five-horsepower steam boilers and six Ritter fans making an immense amount of atmospheric smoke."

For Woodruff, the most difficult part of the shoot was trying to perform the actions required of him while covered with the lead mixture. "Climbing up pipes while covered with that slimy stuff was almost impossible," Woodruff recalled. "We had one set with pipes running horizontally on the stage floor, and at the back end of those was a pit for the top of the lead mold with the lead fluid in it. Fincher mounted a mirror at forty-five degrees, so as we shot into it we were shooting past the alien on the pipes into the mirror reflecting the lead. So it looked as if we were shooting right down the pipes into the mold."

For the obligatory 'shock shot' of the alien — still alive — exploding out of the lead mold, Fincher had assumed a visual effect of some kind would be necessary. Di Sarro, however, convinced him that the effect could be achieved on stage. "*A.I* made us a fiberglass mold of the body and we skinned it with the alien suit. We made a special air mortar to accommodate the body and incorporated that mechanism into the mold. On cue, we blew that alien through about five feet of the lead mixture at two hundred sixty pounds of pressure. It flew fifteen feet in the air and threw lead everywhere. To make the alien look like it was smoking from the molten metal, we used a cigarette smoker, purging a lot of tobacco under pressure to create a cool smoke coming out of the suit."

Di Sarro's assignment also entailed numerous smaller-scale effects, including insert shots of the cryotube featured in the film's opening. "There was a particularly difficult shot," Di Sarro recalled, "involving a closeup of Newt's face through the convex glass of the cryotube, with fingerlike cracks running above her face. We used breakaway glass and made a spring-loaded mechanism that would snap the glass at just the right place, which we determined through a series of tests. We did that about fifteen times. Some of the takes that I thought were beautiful Fincher didn't like because he said he saw the glass move. When we finally cracked the glass without seeing it shimmer, then it made sense to me what he was after. I think David Fincher has one of the most critical eyes I've ever worked with as a director. He knows exactly what he's looking for and he settles for nothing less than perfection."

Boss also extended its work on the film, contributing a complex forty-eight-frame scene in which the alien's superheated head dome cracks due to the temperature differential after being doused by the sprinklers. *A.I* provided a lead-caked alien torso and head and Boss built sufficient lead mold set elements to tie it in with the original photography. "The difficulty was getting the f-stop so that we had deep enough focus," said Rick Fichter. "We had to shoot it with a slow film for optimum quality in the optical process. So it was a logistical problem of getting the right level of light onto the creature without baking the thing." The cracks themselves were computer graphics elements. The head was digitized and the resulting wire frame animatic was rotoscoped so that it would track with the live-action head. An animator then drew the cracks, frame by frame, in black on a flat

sheet. That artwork was scanned into the computer and digitally wrapped around the modeled head so that the cracks would progress from back to front in matched perspective with the footage. Once all the elements were completed, the final shot was composited digitally.

It was also in postproduction that Boss enhanced some earlier scenes in which the inmates and Ripley use fire to drive the monster into the toxic waste disposal vault. “Fincher asked us to add layers of ‘sweetening’ elements to the shots,” recalled Donna Langston. “There was a scene where a fire explosion is coming down the tunnel. On the set, they were afraid the actors in the foreground would be dangerously close to the fire, so they shot a plate of the actors reacting to fire that wasn’t there. Later we built a miniature of the tunnel, lined it up with the actual shot, then filmed a fireball rolling through the miniature and matted that into the plate. In another shot, the creature is standing amidst a lot of fire in the plate and David wanted some licks of flame in the foreground to cover the alien momentarily. So we shot those and comped them in.”

Matte paintings were a critical postproduction effort, utilized to establish scenes of the Fury 161 station and planet images for the opening EEV descent. The wasted planetary surface took the form of a coal-gray globe with darkened relief which looked like elevated sooty clouds when properly lit. A painting of the surface — as from a great altitude — was shot with a complex move into which the tumbling escape module was comped. Other matte shots established the surface environment as a windblown and generally befouled industrial landscape. Ocean plate material from the Newcastle shoot was rear-projected into some of them. Clouds of dark smoke were matted into the shots using color-reversed film of white smoke photographed in the Boss parking lot at night.

To enhance a few of the exterior images, Boss was asked to add a dusky planet — filling much of the sky — and two setting suns. “For the planet,” explained matte department supervisor Michele Moen, “we took a four-by-five transparency of the surface that I had done and projected it onto a globe. The two suns we burned in using holes cut in board that were backlit through a spun material to create diffusion. A move showed one sun setting behind the planet and a smaller one drifting along. These elements were later matted into the painting, which was done by Paul Lasaine.” Rick Fichter spent many hours shooting tests to optimize the corona effect of the setting suns, using scratch filters made in-house and adjusting the exposure to heighten the flaring on the planet’s surface. The matte camera work was orchestrated by Alan Harding.

One particular shot forced the artists into an unusual approach. The live-action footage consisted of men walking over a rise with a black sky and clouds of billowing white smoke in the background. What was needed was a painted Company ‘rescue’ ship, similar to the Sulaco, inserted into the background, behind the smoke already in the image. Such a matte would normally require separate elements of the painting and the live-action, precisely locked together along a matte line. Another standard approach would be to project the live-action onto a white card precisely cut to serve as a hold-out matte for the painting placed behind. “Because there was so much billowing smoke in the scene, any matte line would have cut off some of the smoke,” Moen said, “so I painted right on the duping plane. I could only paint the darker shadow areas on the white board, so it was like painting in the negative. It was tricky, because I had to watch where the smoke would be and decide where I wanted the painting to show up. It’s almost like a ghost image with a lot of fine detail that comes and goes. This was a one-generation shot, done on 35mm so we could just hand it over without having to reduce it.”

The forced perspective set was twenty feet long and equipped with more than fifty quartz halogen lights. Lights were also rigged underneath to suggest convective heat waves venting through the furnace ports.

The film climaxes with a confrontation between Ripley and the alien in the station foundry where lead radiation shielding is produced. Cornered in a lead mold, the creature is deluged with hot molten metal — which fails to kill it. The sequence utilized footage shot on a giant set at Pinewood, as well as postproduction material shot months later on a Fox soundstage where sections of the set were reconstructed. As throughout the film, both live-action and puppet techniques were used to acheive the creature effects.

To match the unpleasant environmental conditions created on set during the live-action shoot, the computer graphics department produced wind-blown debris elements that were composited over the matte paintings and other shots, including plates from principal photography. An attempt to achieve the effect by shooting real debris outside proved unsatisfactory. “Dust and debris would be difficult to create using high-con or bluescreen methods, “Jim Rygiel explained, “because all of the smaller particles, which are what you really want, would be lost in the optical processing. So we used software to create the debris and give the particles a streaky blur. We were producing hundreds of thousands of particles, each of them moving with their own path. The particle system software could give them physical properties, specifying how fast the things moved and simulating the effects of gravity and wind currents.” As another addition to one of the paintings, the computer graphics team animated a streak and matted it in against dark clouds to represent the fiery path of the EEV across the sky.

A composite shot of the lead-covered rod puppet alien stalking Ripley in the foundry.

Boss also produced a number of miniatures, among them a set representing the huge gantries that dominate the Fury 161 station exterior. “The gantries were three-dimensional,” David Jones noted, “but almost all of the paneling and detailing work was painted on. When the main unit filmed the live-action exterior shots at Pinewood, they sometimes added a lot of wind with smoke and debris flying through frame. So we had to match that in our shots by putting smoke and debris in optically.”

The labor load for the Boss model shop grew in proportion to the delays in the movie’s release date. More time meant more shots — and more shots meant more model work. “We were calling it *Alien 3* - Part 2,” observed Jones, “because we’d basically finished production on everything that we had initially contracted for — but the work kept coming.” Production for the model shop was ultimately extended through January 1992. One of the later assignments was the construction of an interior segment of the Sulaco hull from which the EEV would detach and fall away. As conceived by Norman Reynolds, the miniature would have been too expensive to construct. “There were rows of mirror-image EEVs that locked together like a puzzle, which would have meant twice as many patterns and molds. I came up with some different concepts using just one EEV pattern and we faxed drawings over to England for David and Norman to approve. We could duplicate the EEVs and still put them together in a puzzle shape that was busy and indicated that there was a whole row of these things going off out of frame, but it would be more economical to build.”

Because of the nature of the design, almost everying on the wall was scratch-built. “Each item required a pattern, molds formed of that pattern and then multiple castings. David Montgomery did most of that. Fincher wanted the feeling that there would have to be some parts that decouple from the EEV before it could be blasted away. So we added an arm that moves away, which we shot motion control. He also asked for lights to flesh out the shot, and I came up with the idea of adding

some that rotated and could wipe around, focusing your attention. We used stepper motors because they had to be able to match on a couple of different passes. There were a number of other lights on the model that had to be repeatable, too, because they would be shot on a double production pass to balance out the lighting, change timing on the blinking and alter the color of the lights. David kind of played around throughout the movie with adding Japanese symbols on a lot of stuff, figuring that the Japanese would probably own everything by then."

An EEV miniature was required for establishing shots of its drifting in space and approaching the planet. "The model was two inches to the foot and we had top, bottom and side mounts for the bluescreen pylon," Jones said. "We needed it to glow as it entered the atmosphere, so we ended up painting the EEV with invisible black light paint which phosphoresces under the presence of ultraviolet but is clear with a normal lighting pass. So we were able to do passes with the production lighting and then glow passes on separate pieces of film without the expense of repainting. Optical added some diffusion to the glow and could burn it up or down if they wanted."

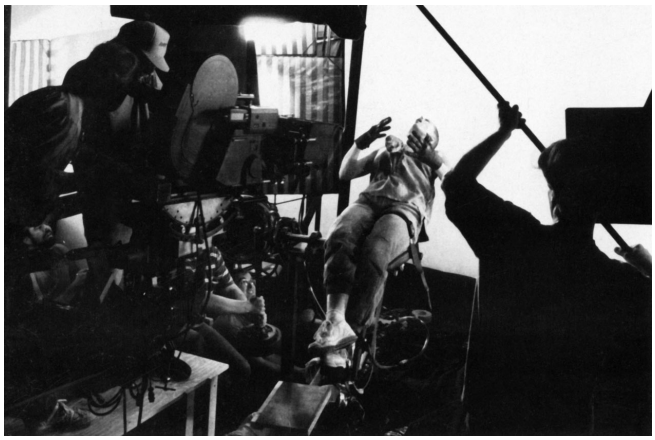
When the sequence of the oxen dragging the damaged EEV on shore was cut, Fincher decided to replace it with a shot of the EEV being lifted out of the water by a crane, also rendered in miniature. "The basic shape and overall proportions of the crane were established by our art director, Brent Boates," noted Jones. "John Eaves did a foamcore mockup of it for David's approval." Built to the scale of the existing EEV miniature, the model was over six feet long. "The crane arm appears to swing away with the EEV underneath, but because we were projecting the actors atop the EEV — which needed to sway naturally — the miniature EEV was mounted on a sway-producing pylon and the projector on a pan-tilt head. The move was then photographed against a bluescreen. Everything else in the shot was a matte painting." The final sequence of the Fiorina inmates recovering the crash-damaged escape module was realized with shots of a full-scale crane lifting George Gibbs' actual-size mockup, shots of their miniature counterparts and a front-projected silhoutte element of men standing on the swinging wreckage.

Another late addition to the miniature work was a satellite communications dish which was used in the story to summon assistance from the Company. "We built the communications satellite to look something like an Iron Age version of a Gold-stone tracking station," related Jones. "The planet's atmosphere is supposed to be very caustic, making machines rust quickly, and so everything has to be built more like bridge trusses than high-tech equipment. David Montgomery built a foamcore mockup to show the size and the relationships and then followed through with the miniature. Fincher had us put 'Weyland Yutani' and 'Fury 161' on it in Japanese. The dish was motion controlled for pivot and a tilt-up because there had to be double passes for the lights on it." The finished model stood approximately eighteen inches tall.

The model shop was also asked to build a large tabletop miniature of the main *Fury* 161 complex showing two giant furnaces venting to the atmosphere. The glow and convective heat waves from the openings had to indicate changing furnace output levels. “Brent Boates did the storyboard concept design that we bid on,” Jones explained. “The storyboard was fairly rough, but indicated the major shapes and positions of items in the frame. I had John Eaves build a small-scale mockup of that out of foamcore. From there, he did a couple of sketches of the possible detailing and style. David wanted to make sure it didn’t look high-tech. Even though the structures were supposed to be made out of steel and iron, he felt they should look like they were almost cast in big concrete sections, like Hoover Dam — no fine detail stuff at all.”

The alien is finally destroyed when Ripley activates a sprinkler system. As cold water cascades onto the beast — which is superheated due to its absorption of heat from the molten metal — the temperature differential literally causes it to explode. For a quick shot of its cranial dome about to shatter, a full-size torso puppet was photographed at Boss and enhanced with computer graphics cracking elements. David Jones dresses the mockup with a simulated lead mixture made of aluminum paste thinned with methocel.

After securing approval of the design, Jones was faced with the problem of building the miniature on a very tight budget. “The only way I could do the furnace set and stay within the budget Fox gave us was to build it out of foamcore, wood doweling and some plastic, using a small crew. The final set measured approximately twenty feet on a side. We had a mixture of one scale with some forced perspective in the background, then added flats in the rear. We had originally built the mockup with spires and verticals, but David definitely did not want it to be *Blade* Runner-ish, so we took them out. After he saw the finished set, however, he had us add the spires back in. The model also had about fifty lights on it, which helped the scale. David wanted to see lights in the distance to show the vastness of the complex. We used hot little quartz halogens and bulbs that were lensed with spots in them. It was all shot in smoke, with the wind-blown debris and diffusion added later.”



Though the alien warrior is vanquished, Ripley still carries the queen embryo within her. Aware that her days are numbered and that the Company intends to preserve the beast for study, Ripley elects to end the horror by leaping into the giant lead furnace. Just as she does so, the queen chest-burster explodes from her body. For the scene — shot only five weeks before the release of the film — Sigourney Weaver was rigged with a chest-burster appliance and photographed in front of a bluescreen in a mechanized chair designed to create the impression of her tumbling backwards into the furnace.

The original Sulaco model from *Aliens* made a cameo appearance in lieu of a painting that Michele Moen had already begun before use of the model was approved. The ship was secured late in the film for a single shot of the Company rescue ship approaching Fiorina. “When we first talked with David,” said Jones, “we told him that we knew where the original model was; but he didn’t want to dwell on the

action before the EEV is ejected. However, when the need for the Company rescue vessel came up, budgets were thrown around to design and build a new ship. Fox really wanted to hold the budget down, so we reminded them that the original Sulaco was still an option and that we could alter it just enough to suggest a different ship of the same class. So we rented the Sulaco from Bob Burns, who has put together a museum of miniature effects. David wanted to change the color to a warmish brown that's kind of a theme throughout the movie. He didn't feel it was necessary to shoot the whole ship; so we painted only the forward portion and then repainted it back when we were done with it, as part of our rental agreement. Pat McClung had supervised the building of that model originally, and he was working at Boss on *Alien 3*; so he was able to fix it up and redo some wiring. The ship was shot from the same side as it had been for *Aliens* because the other side was never detailed or even given any of the basic shapes. We covered up the name on the side with a plate so that we wouldn't have to repaint that. We also took off the jutting side projection and the gun turrets, and we added some lights and a few stripes."

After returning the Sulaco miniature to its original condition, the modelmakers received the unwelcomed news that Fincher wanted another shot of the Company vessel. Fortunately, it was intended to be shown orbiting far above the antenna dish. "It was very small in the frame, only about two or three mils," Jones remarked. "It was just a shape and some lights, so I could have used a cigarette if I'd wanted to. A French bread roll would have done." The restored model was shot with orange lighting to produce the brownish hue Fincher favored, and the replaced components were simply left in place. However, the director had not finished with the modelers. Early response to previews indicated that audiences were confused about the opening montage. A shot of the model as the Sulaco was called for. The problem was that Fincher badly wanted the Sulaco nameplate to be clearly visible, yet he also wanted the ship to go from right to left in the frame, requiring that the unfinished side of the model be shown. As a compromise, Jones had the herald replaced with reversed lettering and the footage was flopped.

Nearly a year after the wrap of principal photography, yet another major change was incorporated into the *Alien 3* production scenario. Even though the director had stood firm in his belief that Ripley should leap into the lead furnace as an act of pure sacrifice, test audiences apparently felt otherwise. At the insistence of the studio — and with only five weeks remaining before the release of the film — Fincher and company regrouped on stage at Boss and shot a compromise scene in which the queen chest-burster erupts out of Ripley's torso as she falls. "To be honest," said Edlund, "I liked the change. The audience kind of expects something like this and it was a payoff that wasn't made with the original ending. The problem was that by the time the decision came down, we had only a little more than two weeks to shoot and composite three or four very complex bluescreen shots — important ones that affected the outcome of the movie and the way people would leave the theater thinking about it. The first thing we had to do was build a motion control seat for Sigourney that was split on the side so the camera could get in really close. We started on a tight closeup with her in an upright position. Then the seat tilted her back toward the bluescreen. When she was about perpendicular to the camera, the chest-burster was fired. Alec and Tom were on hand with nine of their chest-burster units. We went through seven of them — and after each take there was a major cleanup effort. It took a long time to get everything just right. Sigourney grabs the chest-burster and we go to a closeup and then cut back to a fourteen-inch rod puppet Ripley that Laine Liska made in

one weekend and which we follow way, way down into the molten lead." To heighten and prolong the drama, a slow-motion effect was introduced by step-printing every sixth frame twelve times and then dissolving quickly from one to the next.

The last scene of the film, following Ripley's death, employed a miniature dubbed the 'crucifix set' — a metaphorical junk pile with a makeshift cross projecting from it. Shot against bluescreen, an ocean background plate from Newcastle was added along with a matte painting revealing the twin suns and the shadow of a planet filling much of the sky. "The storyboard only indicated the overall size and proportions of the cross," Jones noted, "so I put that out as sort of payback to all the guys who humped on this movie. I had four modelmakers competing. I gave them all the same information, and they went off on their own and each built a cross. We presented them to David and let him pick the one he liked. We did it two inches to the foot, which made the whole set about twelve feet across."

Despite schedules that extended well beyond original estimates, the special effects artists on *Alien 3* were enthusiastic about the production and pleased to have had an opportunity to measure up to the high standards set by the previous two films. The greatest disappointment — for at least some of them — lay in efforts that were started but never came to fruition because of the many changes in direction which characterized the show. "A lot of our work, especially the new stuff that we were really enthusastic about, got cut out," observed Tom Woodruff. "Being creature guys, we almost always would like to see more. But we realize there is a point where you can show too much and it gives away the illusion. I think we achieved a good balance."

David Fincher had mixed feelings about his debut experience as a feature film director. "Everybody did a phenomenal job, considering the restraints that we had. In the end, *Alien 3* is $60 million worth of the best ideas we could come up with on any given day. It was a logistical nightmare, it was a production nightmare and it was a micromanagement nightmare. If the movie is only half as scary as the experience of making it, then we'll do very well."

Alien 3 photographs copyright © 1992 by Twentieth Century Fox Film Corporation. All rights reserved. Production unit still photography by Bob Penn. Boss Film Studios still photography by Virgil Mirano. Amalgamated Dynamics still photography by Tom Woodruff. *Special thanks to Paulette Dauber, Claire Wilson and Denise Balbier.*

CYBERWORLD

image

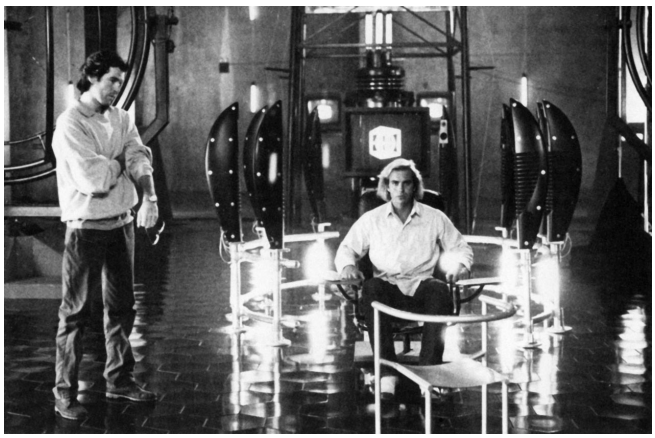
article by

Peter Sørensen

The computer revolution, while still in its early stages, has become assimilated into our daily lives to the point where it is now taken largely for granted. Personal computers and video games abound, as do calculator wrist watches and automatic teller machines — all products of the computer age. Nonetheless, most experts predict that we are on the brink of yet another new level of involvement with computers, an involvement which will make the present one seem positively primitive by comparison. Virtual reality — 'VR' for short — is the technology that will almost certainly re-revolutionize our computer experience by the year 2000.

Although there is new equipment involved, virtual reality is not a new kind of computer so much as it is a new way of using and relating to our computers. The vast majority of today's users sit at keyboards and type in exactly the same way that secretaries on typewriters did more than a century ago. We may use a mouse or other pointing device to speed things up, but that cursed 'QWERTY' keyboard — so called because of the sequence of characters on the top row of letters — still tyrannizes most of us. Of course, computer games use joysticks, and information kiosks at museums have touch screens that do away with gizmos altogether; but practically every method of interfacing we are likely to have used to date has imposed a separation between us and the process itself. Even the TV-like computer monitor, accepted without question as the common-sense way to get feedback from the machine, has always been 'over there' at arm's length — just a part of the world around us rather than a means of immersing us in our work or play. Virtual reality, however, will take us right inside the action.

In The Lawnmower Man, intellectually impaired Jobe Smith (Jeff Fahey) becomes the subject of mind enhancement experiments conducted by Dr. Lawrence Angelo (Pierce Brosnan). Excited by the potential applications of virtual reality — an interactive computer technology in which participants become a part of the computer graphics experience — director Brett Leonard and producer Gimel Everett, expanded on a Stephen King short story, adding the element of 'VR' to the slender plotline. Jobe's first encounter with virtual reality is in Angelo's basement lab, where he is first hooked up to a VR version of a video game and then later exposed to more advanced forms of the technology.



When Angelo's work with Jobe progresses beyond the technical capabilities of his own equipment, the doctor takes his subject to Virtual Space Industries where covert experiments in virtual reality are being conducted. The futuristic VSI cyberlab was conceived by production designer Alex McDowell.

Virtual reality systems employ new ways of interacting with the computer and new ways of experiencing the results. The most important part of a full-blown, off-the-shelf system is the 'eyephone' — stereoscopic goggles displaying true 3-D computer graphic imagery on tiny twin TV screens — linked with stereophonic earphones for audio. For input — good riddance, QWE*.T.* — a far more natural method of interacting with the computer involves the use of a 'DataGlove' made by VPL Research. The glove has sensors built into it that detect when and how the operator moves. That motion data is sent to the computer, which typically displays for the wearer a 3-D synthetic image of a hand floating in space. As the operator wiggles his or her fingers, the computer generated hand mimics every move. The synthetic environment contains representations of objects located in 3-D space, and one can actually reach out and grab those objects simply by putting the virtual glove into the same location and closing the fist. Some systems even have little air bladders in the glove that inflate when the operator 'touches' something, giving the sensation of pressure. With a 'DataSuit' — also a product of VPL Research — the whole body can be similarly involved. The effect is that of being in an environment which can be anything that a VR computer programmer, or 'spacemaker,' can imagine — at least within the practical limits of today's reasonably powerful machines. VR is like dreaming, except that one has free will and others can don the paraphernalia and share in the experience.

Virtual reality has already progressed well beyond the bounds of science fiction. VR is now a tool for medical students and even plastic surgeons, affording a risk-free and viable simulation of each surgical incision. In molecular chemistry, scientists can push atoms together and feel how they attract or repel each other. By pointing a finger in the direction they want to go, financial analysts can fly around massive landscapes representing commodities market data. With virtual reality, architects can show clients what their buildings will be like when constructed — including the view from the boss' penthouse window. A Japanese university is experimenting with VR systems designed to test new products such as video cameras before they are ever built. Air traffic controllers can see planes in three-space and pick the one they want to communicate with simply by touching it with the glove. And, of course, pilots have been using flight simulators for decades. Simulators are much older than the term 'virtual reality,' but the real-time computer generated sights, sounds and motion combined with interactivity qualify such cockpit mockups as 'full immersion' VR. Sports and recreation also offer burgeoning applications. The U.S. Olympic bobsled team practiced on a bobsled simulator, and one can already buy programs for VR sports like raquetball. There are even VR musical instruments in the works. In fact, virtual reality pioneers Jaron Lanier and Tom Zimmerman made the first DataGlove so they could play air guitar!

Realizing that the current state of the art of virtual reality was only the crude beginning of something really big, filmmakers Brett Leonard and Gimel Everett began to fantasize about what the future might bring. Using a seven-page Stephen King short story, "*The Lawnmower Man*," as a starting point, they expanded considerably on the slender plotline, adding virtual reality as an exciting new ingredient. Having cowritten the script, the filmmakers secured independent financing for the project from Allied Vision and Lane/Pringle Productions, and set about achieving their vision, with Leonard directing the film and Everett acting as producer and second unit director.

The Lawnmower Man — released theatrically by New Line Cinema — employs a wide range of effects, including miniatures and pyrotechnics by David Stipes Productions and practical effects by Reel Efx.

But most significantly, it is the first feature film to use computer graphics in a big way since *Terminator 2* awakened audiences and producers to its feature film capabilities. The computer graphics in *The Lawnmower Man*, while used very differently from those in T2, are in some ways even more exciting, although not as photorealistic. The picture's entire $6.5 million budget was actually about the same as T2's computer graphics cost alone. Even more remarkable, *The Lawnmower Man* contains far more computer imagery.

In their capacity as screenwriters, Leonard and Everett — who have worked together for ten years — stretched the bounds of creative license to speculate that virtual reality, combined with mind-enhancing drugs, might be used to increase a person's IQ and perhaps even impart psychic powers. "Gimel and I live in Northern California where a lot of the virtual reality technology was spawned," Leonard recalled, "and we had been wanting to do a 'cyber' film for quite a while. We saw in the character of the *Lawnmower Man* an opportunity to show a person being transformed by this new technology in a kind of classic way — like the characters in *Frankenstein* or *The Fly*. There's a whole sub-genre of science fiction called cyberpunk; and virtual reality is of that ilk. It's something that's incredibly fascinating to think about as we move toward the turn of the millennium. What is going to happen with the human-machine interface? As we blend with the machines that extend our minds and bodies, what will the impact be on our culture? How will it affect the way people communicate? Or the way they make love? These are some of the things we deal with in the film. We're postulating certain effects that might happen to a human being subjected to brain stimulation using virtual reality. But it's still all based on taking virtual reality where it is now and extrapolating it several years into the future. The interesting thing to me as a storyteller is the mythology behind it all. There's a great myth in the man-machine interface taking over culture. Which side will win? What will be the spirit in the machine? That's what our little cautionary tale is all about."

Actor Jeff Fahey plays Jobe Smith, the *Lawnmower Man*, an adult with the intelligence of a six-year-old, who lives under the repressive care of Father McKeen (Jeremy Slate), a strait-laced Catholic priest, and tends to people's yards for his keep. Since few of the VR movie props he would be called upon to use were truly functional, Fahey was given the opportunity to experience real virtual reality systems in preparation for his role. "I was amazed to find out that virtual reality does, in fact, exist — and that made this even more exciting. It's incredible that you can become a part of, and be within, that dimension, and see yourself as part of the computer graphics." Jobe's best friend is ten-year-old Peter Parkette (Austin O'Brien). For O'Brien, using the VR equipment was like being in a magical toy store — although it could be overwhelming. "It's really cool moving in all directions, but you've got to get used to it. The first time I tried it, I had just had a big breakfast. Not a good idea!"

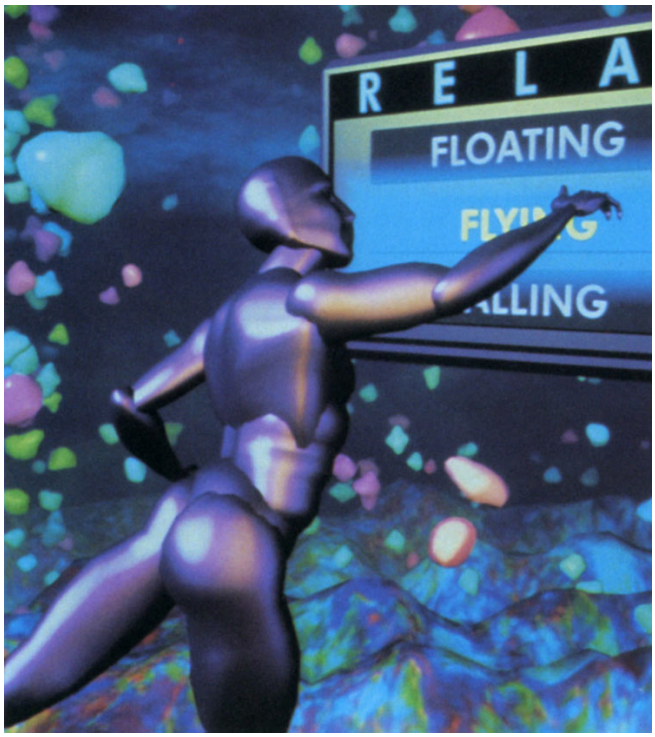
Leonard and Everett were also intrigued by the artistic possibilities of computer graphics. "One of the reasons we were attracted to this subject was because it's inherently cinematic," Leonard affirmed. "It's completely visual. You put on these goggles and this DataSuit and your movements are translated into the computer that then creates a three-dimensional computer graphic universe around you. It lends itself very well to a cinema story; but it was a little scary, because we were treading on uncharted ground to give audiences something they've never seen before. The interesting thing is that the effects technologies we were using, the computer imaging, is the basis for virtual reality itself. We weren't working with virtual reality companies per se, but we were

working in the same arena to portray virtual reality in the film. So it's like the process reflecting the concept."

Choosing which computer animation facilities were up to the task on a tight budget was tricky. Based on motivation and design sensibility, Leonard decided to give the lion's share of the work to Angel Studios in San Diego and Xaos, Inc. of San Francisco. "I met with more than thirty individuals representing different companies, from Pixar to you name it; and we found that everyone was using similar tools, but that what was important was the artists using those tools. In going with Angel and Xaos, we were choosing companies that have a very specific point of view to their design — and they were dying to break out of commercials because that can be stifling compared to what they are capable of doing."

Completely surrounded by synthetic sights and sounds, Jobe participates in the 'Cyberboogie' game through his computer 'cyberform' character — flying through tunnels, dodging floating mines and evading attackers. Imagery for the game was produced by Angel Studios who, along with Xaos, Inc., generated the majority of the film's computer graphics shots.

Angel Studios' computer graphics work on *The Lawnmower Man* ranged from creating the main title image to generating most of the virtual reality scenes, many featuring 'cyberform' characters. Earlier, the facility had produced space animation for NASA, Shamu the orca for a Sea World commercial, a fire-breathing dragon for Nintendo and much more. Brad Hunt, president and director of visualization and software development for the facility, heralds from the now defunct Digital Productions where he had worked on both *The Last Starfighter* and *2010*. "What we did for *The Lawnmower Man* was try to imagine what VR imagery might really be like in three to five years. The beauty of this project is that our animation doesn't compete with reality. The images are stylized to look computer generated. We worked with Brett and Gimel and storyboard artist Albert Co in the effects and scene design for two months prior to actual production. The director wanted vibrant colors and abstract elements so that when the VR 'user' puts the helmet on, the audience sees a really different type of world. That gave us an opportunity to do surreal things with the photography. And the director and producers were as excited about the exploration as we were. They were like a cheering



section saying, 'Go, go, go!'" Other key players on the Angel team were creative director and animator Jill Hunt, a perfectionist with a degree in advertising design and extensive experience in photography, and director of animation Michael Limber, who comes from an architectural and industrial design background. "The biggest problem we had was doing the animation very, very economically. We created eight minutes of footage in about six months, with only three technical directors and two assistants. It was phenomenal that we met that challenge without going over budget or over schedule. It took eighteen hours a day and all the computers cranking constantly."

In a later sequence, Angelo likewise avails himself of the VR technology, donning eyephones and a DataGlove. In the VR environment, his cyberform selects from a relaxation menu. After opting for a 'falling' experience, his form descends through colored liquid particle blobs animated by Angel Studios.

Angel also produced the computer graphics sequence in which Jobe explores the more carnal applications of virtual reality via a virtual sex experience with his girlfriend. Covering Jobe's cyberform was a green texture map derived from a fractal pattern.

A good team of computer graphics software people and animators working together can go where no special effects have gone before. With objects comprised of massless geometric descriptions and rendered by calculating how they would reflect light into a camera, computer graphics is free from the tyranny of physics. Unlike its counterpart in the physical world, the computer graphics model has no gravity to weight it down. Nor are there material properties to worry about, such as glue melting under the heat of bright lights. It has none of the limitations of motion control rigs or optics. Compositing within the computer's world is not a problem and there is no need to shoot multiple passes. Nor is track length a limitation. One can zoom in on an object nonstop, from out beyond the edge of the universe down to within an atom in one uninterrupted take. Things can change shape almost as easily as with clay animation, but with the advantage that should it need to be changed, the animator doesn't have to do the whole damn thing over again!

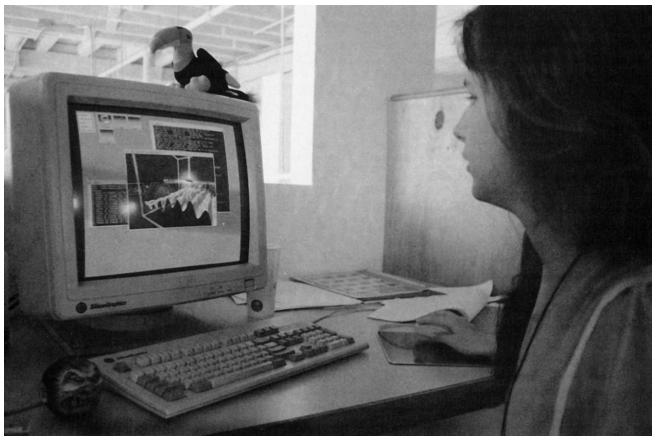
Of course, computer graphics has limitations. Unlike live-action photography, every detail has to be created or defined. Most available animation software does not have physics built into it; so if the computer animator wants a ball to bounce, his approach must be much the same as the traditional animator's. Key frames have to be created for the extreme positions before the computer can go to work. Nor are objects solid. If care is not exercised, objects can easily pass through one another. Simple everyday realism is an elusive goal. Computer images are notorious for looking cold and antiseptic, with objects often looking like plastic or glass. Organic shapes and patterns are rare, and something as simple as the folds in a tablecloth are excruciating to model. Still, great strides have been made recently, and *The Lawnmower Man* takes advantage of many of them.

Among the organic software tools used within the film is one designed to make 'particle systems.' This technique allows the animator to control the motion of thousands of separate dots or objects in three-space with commands that define the behavior and direction of the whole swarm while the computer, using a little randomness, moves every individual particle differently on its own. Brad Hunt employed a straightforward particle system to create the main title, with a multitude of little green sparks forming the graphic logo.

The story opens in a futuristic cyberlab, with a boosted-IQ chimpanzee in a threatening VR battlefield environment. Computer graphics in the sequence, produced at Angel Studios, utilized Wavefront Technologies' high-end, off-the-shelf software augmented by Angel's proprietary Scenix

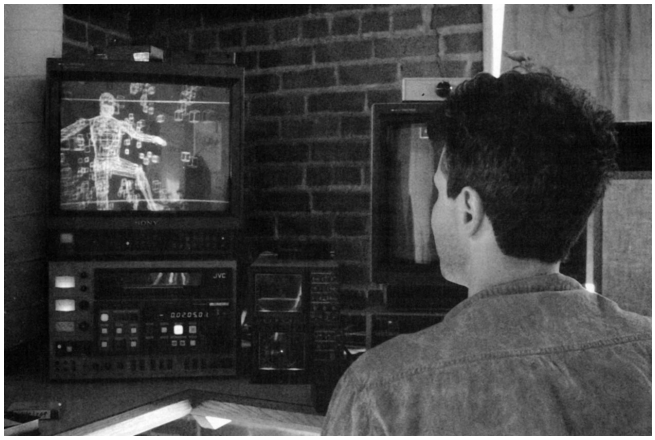
tool kit. “The chimp’s POV was supposed to look like it was inside a computer,” said Michael Limber, “and the producers wanted us to emphasize the polygon aesthetic. Managing it all, and keeping it all consistent, was the big challenge.” The experiments being done at Virtual Space Industries are designed to render the subject apes aggressive and intelligent enough to be used in high-tech battlefield situations. When the chimp escapes and goes on a rampage that results in its death, Dr. Lawrence Angelo (Pierce Brosnan) decides to take a leave of absence and try to redirect his research to more positive ends. Working on his own, he entices the retarded *Lawnmower Man* to become his subject in a new exploration of mind enhancement. In his home lab, Angelo begins by introducing Jobe to the VR eyephones and by letting him play virtual reality video games with Peter Parkette. The ‘Cyberboogie’ game in which they initially engage is enhanced by interactive hydraulic couches — built by Reel Efx — that pitch and roll to give the VR participants the sensation of true motion. Surrounded by synthetic sights and sounds, Jobe has a grand time inside computer space where the players’ cyberform surrogates wear winged flying suits and go soaring down tubes, weaving among swarms of hovering spiked mines and dodging between rows of chomping blades.

The hovering mines were animated with a particle system algorithm. Originally devised to give motion to minute points of light, as in the title sequence, the algorithm here was employed to control rather large objects. “Animating objects with the particle system was a challenge,” Limber remarked, “because the game players had to fly between the spiked balls which the particle system was operating on its own. So when we had a player flying in there, we had to make sure that our character wasn’t going to pass right through something. We had to customize the motion of a few of the balls to make them do what we wanted them to. Having that work in real time would have been much more fun — then we would have been really playing the game — but algorithmic animation with the key frame stuff adds just tons of detail that you could never do by hand.”



Animator Roberta Brandao works on imagery produced at the Xaos facility for a scene in which Angelo uses VR waveforms to stimulate Jobe’s underdeveloped brain and accelerate his learning.

The basic interface design for monitor menus — the flashing red dot with the word ‘Recording’ on a gray background — was done by Reel Time Spfx. Other more elaborate monitor screens and the most complex VR scenes were accomplished by Xaos — pronounced like ‘chaos’ — a *San Francisco* company that specializes in the most unusual eye candy around. “Xaos is very unique,” asserted Leonard, “in that they have this software image processing — ‘wet science’ stuff, they call it — and other



A particle system was employed for a later sequence in which Jobe uses his runaway psychic powers to dissolve a team of VSI gunmen into swirling balls of flesh. Animation for the scene was developed with low resolution wireframe figures and then rendered in high

techniques that they used in this film. They did some very abstract stuff."

resolution. Animator Eric Texier examines some of the wireframe imagery for the beginning stages of the effect. Specializing in organic types of imagery, Xaos was assigned most of the computer graphics scenes requiring complex interaction with live characters.

Xaos was founded by Arthur Schwartzberg and Michael Tolson to produce computer animation and publish software. Schwartzberg is the business mind of the firm while Tolson is its artistic heart, being both a talented artist and a gifted software architect. Even in a field like computer graphics, where there is a lot of creative work being done, the imagery produced by Xaos stands out. On the strength of Tolson's highly unusual programming ideas, the company garnered widespread attention with its exceptionally organic opening for MTV's Liquid Television program which shows a glowing blue bottle slowly becoming immersed in a fluid sea in which little television sets swim all around and leap into the air.

Xaos programs use software building blocks — which are like mini-programs that can be plugged together by the animator in countless ways. The company also relies heavily on 'message passing.' Message passing and building blocks are related. Message passing is a pattern of messages moving between the block parts of the program, and even separate computers, all working independently. Another Tolson specialty is to build into the objects that are being animated a knowledge of their environment, including a sense of time. Each object thus has something akin to artificial intelligence — but not quite — giving it the ability to react to other things. This tends to produce very complex and interesting results — often unpredictable — from relatively simple animation commands.

Xaos imagery is introduced during a scene in which Angelo attempts to stimulate the brain of his subject by exposing him to advanced VR technology. Xaos art director Mark Malmberg, whose background is in fine arts and music, oversaw production of these VR images, as well as others when Angelo takes Jobe to the cyberlab and gives him drug injections to accelerate his learning. "Brett and Gimel were just finishing their script when they approached us looking for very different kinds of imagery. They had a clear sense of what they needed from a directorial standpoint. They knew what the action had to be in these scenes, and the emotional content; but as far as what the scenes would look like, they were seeking our input. That was a perfect opportunity for us, because we like to have as much creative freedom as possible. Brett spoke to many computer companies around the same period of time, but he came to us because we had a strong ability to integrate with live-action and to bring together the different animation formats of other people's work." The decision to utilize additional companies was acknowledged early on as essential. "With nearly twenty minutes of digital scenes, what they needed was more than any one facility normally does in a two-year period."

The 'brain stimulation' scenes are seen from Jobe's virtual reality point of view and on the computer terminal screen in Angelo's basement lab. "The treatments which Angelo has devised for brain enhancement," Malmberg explained, "are a combination of neutropic drug therapy and VR bombardment with geometric forms which have been gathered from ancient cultures and religions. These forms are believed by many to alter the workings of our minds and even to be pathways to otherworldly forces. We consulted a 'sacred geometrist' who supplied information and examples in that domain." For the first 'brainstorm' in Angelo's basement, animator Hayden Landis used this information to create a strobing, high-impact scene in which the viewer is subjected to hundreds of

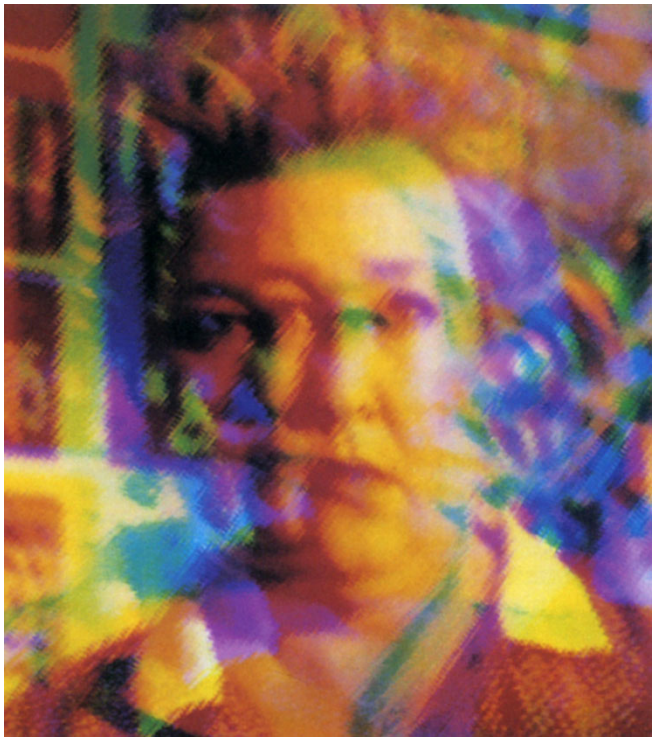
such icons over a period of a few seconds. “An unusual aspect of this work was that there was some serious concern on the part of the sacred geometrist as to the possible effects of this imagery on the audience.”

When his progress with Jobe exceeds the capabilities of his tiny home lab, Angelo takes his subject to the VSI cyberlab to continue the stimulation work. Within the giant lab — conceived by production designer Alex McDowell — the ubiquitous monitor screens display Virtual Space Industries logos and other generic graphics running continually. These were created by yet a fourth computer graphics facility, The Gosney Company. Heading the San Diego firm is Michael Gosney, who also publishes and edits Verbum, a desktop publishing magazine with an emphasis on graphics. Employing a Macintosh computer running MacroMind Director with MacroMind 3-D, Gosney constructed and animated the VSI corporate logo and the other graphics on the cyberlab computer. Mathematica software was utilized to create the pulsating, interlocking toruses, describing them not with polygons, but as a simple mathematic formula. Jack Davis, graphics editor of Verbum, designed the logo.

Jobe and Angelo put on cybersuits and strap themselves into ‘gyrospheres’ for the ride into digital space. The suits and the gyrospheres, plus other paraphernalia, were provided by Reel Efx, a Hollywood physical effects firm with credits on the *Friday* the 13th and *Nightmare on Elm Street* series. Jim Gill, a partner in the company with Martin Becker, abandoned a career in commodities trading to get into special effects. Gill designed and built the functional gyrospheres, which suspended the actors so they could rotate three hundred sixty degrees in any direction while their characters were supposedly in virtual reality. The gyrospheres consisted of three gimbaled hoops — nine feet in diameter and made out of steel tubing — that rotated at ninety-degree angles to each other. Each had footrests, handholds and cables that went to a metal belt the actors would attach to their waists when getting aboard. “The hip belt tied into a full harness that fit underneath the wardrobe and kept the actors from slipping out,” explained Gill. “The gyrospheres were hydraulically actuated and could be fairly abrupt in their movements. The hydraulic motors had five-to-one reduction gears on each of the axes for clean, precise control over the position of the hoops. To insure unlimited revolving capability, we used rotary hydraulic joints to carry the fluid. Otherwise, you would twist the hoses up if you went around more than twice. Each axis had a resolver on it — a feedback circuit — that told our computer exactly where the hoop was. The gyrospheres were a lot of fun to use. Since the pivot point was right on the center of the stomach, there was no gut-wrenching force to make you ill. It was actually a soothing feeling; so it may have a future as a computer simulation motion feedback device.” Sharing the supervisory chores at Reel Efx was Erick Brennan, who designed the VR helmets and gloves — also the suits, which featured decorative piping provided by Wildfire that was sensitive to ultraviolet light and would glow ominously when Jobe was using his cyberpowers later in the film.

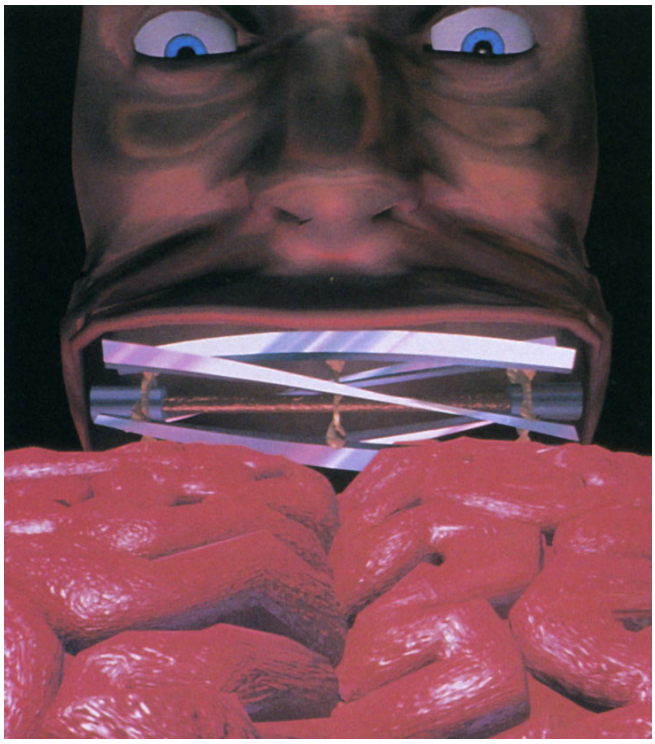
Riding the gyrosphere and floating in the VR universe, Jobe responds quickly to Angelo’s accelerated learning treatment. Malmberg and his team developed a POV for Dr. Angelo in VR space. After a brief shot by Roberta Brandao representing a trip through a glowing fiberoptic channel, Angelo sees a big brain model in front of him. He adjusts three-dimensional waveforms with his glove, changing their shape and putting them into the brain — which affects Jobe. “Then the film cuts to Jobe in his gyrosphere,” Malmberg noted, “and you see what he is seeing — a spiral formation that he goes

flying down into. Next, he starts spinning around in the gyrosphere, and his POV shows stuff flying wildly toward camera. That ends with a warning of brain swelling, and Angelo runs over and gets Jobe out. Part of our challenge was to imagine what VR environments might look like at the point where they're being used in this kind of application; and we thought that information could be displayed in three-dimensional and highly visual ways. We wanted to stay away from text and numbers and that type of thing. We have a great interest, in general, in bridging the gap between 2-D and 3-D; and we do a lot of work where we take 2-D imagery and turn it into 3-D forms. The informational displays were 2-D animations created with our image processing tools, which we converted to polygonal models for rendering within the 3-D scene. The brain model, however, was a plastic medical model that we digitized with a laser scanner."



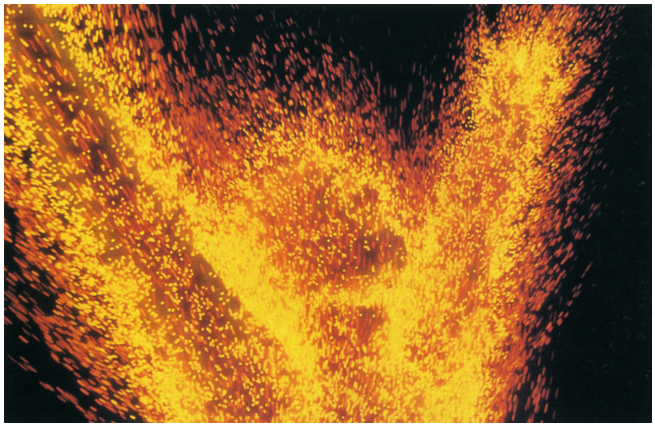
Aggression drugs secretly given to Jobe cause him to develop telepathic powers — first evidenced in a diner where he finds that he is able to read the thoughts of those around him. His skewed visual perceptions accompanying the experience were created at Western Images where color components were digitally isolated from the production footage and jarringly juxtaposed.

Xaos produced an organic 'cyberhell' to represent the disturbed state of Jobe's mind after he is given the drugs.



A wrathful Jobe begins to seek vengeance on his enemies. By applying his telepathic and telekinetic skills, he reaches inside one victim's mind and destroys it. For a literal representation of the mental assault, Angel Studios animated a representation of Jobe, with lawnmower blades for teeth, slicing his way through the man's brain.

For earlier scenes in the basement lab, a real VPL glove was used by Brosnan, and the CG hand on the monitor following his moves was generated in real time by a Silicon Graphics computer. In the cyberlab set, however, the suits and eyephones were nonfunctional, and the graphics experienced by the audience were animated at the Xaos facility in nothing like real time. "It may look like all the computer generated hand gestures seen in the virtual reality were done by people wearing VR gloves," said animator Ken Pearce, "but it really was nuts-and-bolts animation with a lot of work to make it look natural."



Jobe also uses his telekinetic powers to set an abusive priest ablaze. Homer and Associates employed an advanced motion capture system and a computer graphics particle system to create the flame effect.

One of the Xaos computer graphics tricks that very few other companies use is 'recursion.' Recursion is a hierarchical process in which two or more objects relate to each other, like torso to arm to forearm to hand to finger. The more dominant object is called the parent and the subordinate one is the child. Thus, in this example, the hand would be the child of the forearm, and the finger the child of the hand. What sets recursion apart from a normal hierarchy is that the chain of command ultimately loops around to the starting point and the original parent becomes a child of its own children, thus creating a feedback situation that can have interesting results.

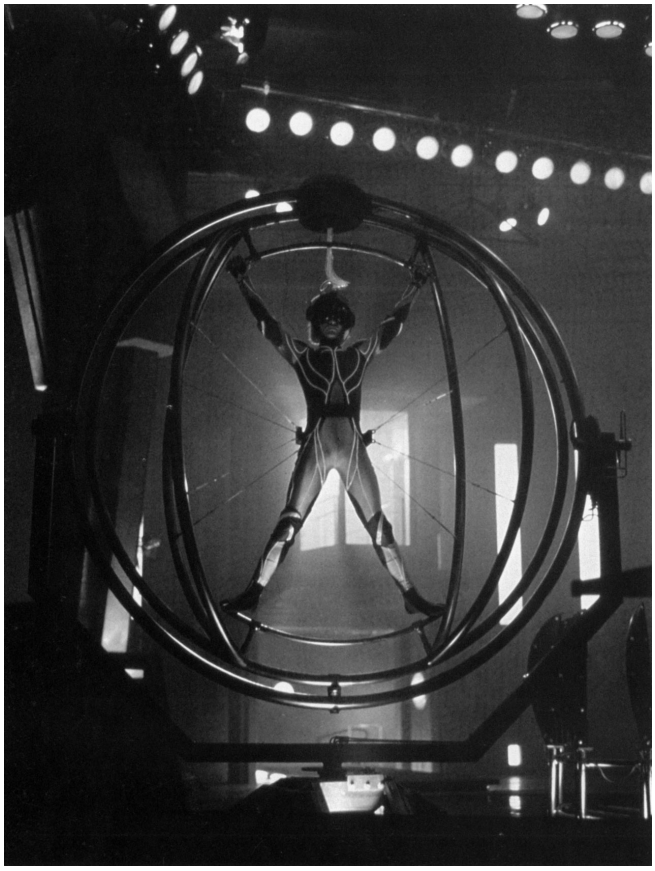
After his killing spree, Jobe retreats to Angelo's lab, where he enters a VR 'cybergarden' created by Xaos.

"Recursion is a very useful tool for creating a very large array of any given element," stated Malmberg. "For instance, we made a ceiling for Angelo's POV that is a tiling of dark magenta hexagons. Those hexagons are all rotating and scaling (changing size) very slowly, but there's actually only one hexagon. Through recursion, you have an event which copies the hexagon, displaces it, and rotates and scales it. If you set the recursive depth to five hundred, you get a line of five hundred hexagons. You can then take that event and make another recursion that takes the event and repeats it back along the Z (depth) axis. The result is a vast field of hexagons, all moving synchronously. From there, the trick is to reach down into the recursion and do things individually. You can easily do 'global' things that distort the whole field of hexagons — you could run a wave through them, for example. In order to go into a local event and give it behavior different from that of adjacent events, we have several techniques. One is to animate time through recursion so that each event sees itself as being at a different point in time. Hence, a local animation, such as a rotation, which is shared by all events in the recursion, can have a different value for each event at any one point in the 'global' time frame."

Sometimes Xaos simply scanned in pictures and diagrams and used them in a strobing fashion with the spiral. "For one of the later scenes where Jobe is becoming evil and everything turns orange

red, we came across an old English document that had seals of various demons. So we approximated one of those and had it spiraling up — distorted, so you couldn't actually read it. At the same time, we had these swarms of geometries that were flying up. The spiral is hypnotic, a somewhat trance-inducing element. It was funny to watch poor Hayden Landis, who had to work on this scene for six months, sitting in front of a monitor watching this spiral with all these pieces of geometry. We were hoping we could get a whole theater full of people to discorporate simultaneously."

Later, to relax in his basement, Angelo puts on VPL eyephones and the DataGlove. Though the props were real, the animation the doctor experiences was generated beforehand by Angel Studios. From his point of view — as he selects from a suspended menu that reads 'Floating / *Flying* / Falling' — the audience observes liquid particle system color blobs wobbling in space above an undulating landscape. Angelo chooses 'falling' by pointing at the menu, and his cyberform descends, gliding among the color for some while.



Overcome by megalomania and determined to merge with the virtual reality world, Jobe returns unaccompanied to the cyberlab where he straps himself into a gyrosphere for a ride into digital space. The dual gyrospheres — designed and built by Reel Efx — were capable of rotating the actors three-hundred-sixty degrees in any direction. Consisting of three nine-foot-diameter hoops, each was equipped with a concealed cable harness which secured the actors to the rig as it revolved. Reel Efx also designed and fabricated the VR helmets and gloves, as well as the cybersuits enhanced with decorative piping sensitive to ultraviolet light. On-set utilization of a UV lighting system — provided by Wildfire — caused the piping to glow ominously whenever Jobe used his telekinetic cyberpowers.

The doctor's moments of peaceful self-absorption are shortlived, however, for as Jobe's intelligence grows, the experiment gets totally out of control — especially after Virtual Space Industries executive Sebastian Timms (Mark Bringleson) secretly substitutes the chimp aggression formula for the IQ drugs. Eventually Jobe begins to become telepathic and even telekinetic. After a demonstration of his ability to move physical objects by focusing his mind, in a heightened state of awareness, Jobe tells Angelo that rather than tapping into new parts of the brain, they have instead been awakening the most ancient. Indeed, though his life has ostensibly taken a turn for the better, the *Lawnmower Man*'s gentle nature has begun to warp disturbingly, and the abuses heaped upon him since childhood trigger a succession of vengeful reprisals.

Among the new attractions in his life is a young woman, Marnie Burke (Jenny Wright), who now finds Jobe both physically and intellectually stimulating. Eager to push the boundaries of their relationship, the two steal into the VSI cyberlab one night to experience virtual sex on the gyrospheres. In the VR animation produced by Angel Studios, Mamie appears as a chrome cyberform. In nearby computer space, Jobe materializes from polygons flying

into place. “We wanted to use the artifacts of the database in an interesting design way,” said Brad Hunt, “as well as to emphasize the basic components of a VR environment — polygons. Hopefully, the success of the movie will nudge Hollywood to embrace the aesthetic of computer graphics in its raw form.” Covering Jobe’s cyberform is a green ‘texture map’ derived from a fractal pattern. Texture mapping may be thought of as a computer graphics method for wrapping a flat image — like a decal — over the surface of an object. In this case, the map was generated by a fractal program that literally splits the space between the dimensions, resulting in the curlicues of a ‘Mandelbrot set’ — named for the discoverer of fractals.

The cybersex sequence commences with a sensual kiss that takes a humorous turn when the characters’ lips stick together and stretch like taffy. Moments later, the elastic algorithm used for the scene was employed once again to create a gluelike substance in which Marnie gets stuck. Jill Hunt enjoyed animating the two cyberforms in these scenes, and others in which the synthetic characters had to move in realistic ways. “It was a big challenge to make two characters interact with motion that was believable, while using color, texture and metamorphosis to express the romantic interlude. My favorite part was the kiss, because it carried so much emotion. I enjoy creating human expression. It’s a lot like acting — in fact, we did quite a bit of acting around here.” Husband Brad Hunt found the sequence equally enjoyable, but from a less romantic perspective. “I had fun as a programmer taking existing algorithms that we had developed and customizing them for this project. In particular, there was a lot of work in the sex scene that made use of spring equations to connect the two lovers when they were kissing and when Marnie gets stuck in the muck. This was very simple physics that had been well thought out initially, although we did fine-tune it as we went along.”

The lovers entwine and twist like a big corkscrew and free-fall down a whirlpool, coming out the other side as a double-headed dragonfly. “That was Brett’s idea,” Jill Hunt explained. “He had a pretty good idea of what he wanted the love scene to look like. I liked the muck!” That sticky goo represents something dangerous in Marnie’s subconscious which surfaces seconds later when Jobe — able to read his partner’s mind and seeing her primal desires — shape-shifts into a bizarre monster with undulating eye stalks and a gaping maw. Horrified by the nightmare vision, Marnie retreats into irreversible madness.”

The beginning of the end for Jobe comes when he decides to shape his own destiny by injecting himself with multiple doses of the mind-boosting drug, unaware that the aggression formula Timms has substituted is destroying him. Too late, Angelo learns of the drug switching and attempts to save Jobe. By this time, however, the *Lawnmower Man* has transformed into the personification of wrath.

Jobe first utilizes his telekinetic powers to set the heartless Father McKeen ablaze. The effect was accomplished with computer graphics using yet another particle system technique — this time executed by Homer and Associates of Hollywood. Particles can be made to emanate from an existing moving image, such as a computer generated object, or from a rotoscoped live-action subject. The computer graphics team at Homer used both. “For the burning priest sequence,” said president Peter Conn, “we used a motion capture system employed for the first time ever in a feature film. The equipment was originally developed for biomedical research and was brought over from Italy specifically to do *The Lawnmower Man*. Francesco Chiarini and Umberto Lazzari developed

the application software that allows one to sample human motion in real time and apply it to a computer animated model. We sampled an actor in our motion capture lab, which is a calibrated space surrounded by four infrared video cameras. The person had Scotchlite-type markers on him which the system would track very accurately to create a 3-D motion database. The motion data we obtained was then used to animate a computer generated figure derived from the particles. Applying our in-house particle system software — written by John Adamczyk, who was also our technical director — we generated some eighty thousand particles per frame.

"On the first shot, when the priest's arm is catching fire, we did some image processing to isolate the actor's arm. Then we used that isolated arm to drive the particles, since they needed a source. On the main shot, our actor matched Father McKeen's position for the motion capture sample. From the captured data, a moving CG figure was obtained that could give off the particle system fire. Then, as the fire overtook the body, we dissolved away leaving just the CG effects over the background. Of course, we supervised the shooting of the background plates to make sure that the interactive flickering orange lights would look right. Whereas most of the movie was done with digital composites, I opted to do this as a full optical composite, and we burned in the fire as a multiple pass effect."

Jobe next proceeds to get even with a gas station attendant who had bullied him, turning the surly redneck into a blithering idiot after telekinetically tying him up with the gas pump hoses. To symbolize the bully's mind being destroyed, Angel Studios animated an evil Jobe face, with lawnmower blades for teeth, chewing a swath across the convoluted surface of his victim's brain. Michael Limber animated the implanted cyberimage. "In an early version, we actually had chunks of brain flying out; but that proved a little bit much to look at."

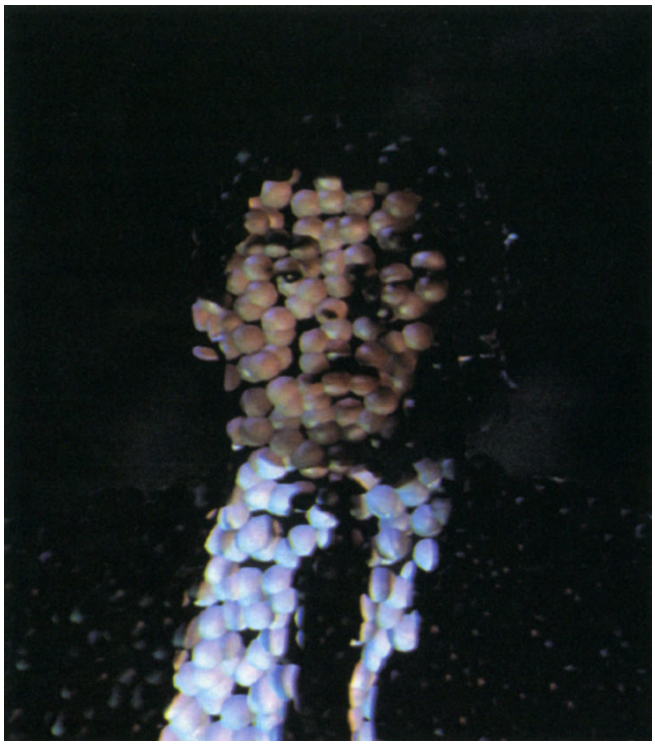
After next killing Peter's abusive father by telekinetically running him down with a power lawnmower, Jobe retires to Angelo's basement retreat and puts on the VPL eyephones to relax one last time. The remarkable imagery — first bright, then foreboding — is representative of Xaos' unique, impressionistic image processing software. Reflecting on a happier time, Jobe is in a 'cybergarden' with colors from a live-action background plate swimming into one another. But by this time, his mind is so unbalanced that he cannot lock onto the dreamy vision and the cybergarden gives way to a big purple vortex in the sky as his mood shifts to a more menacingly ominous state.

"The work Xaos really focused on was the stuff that required integration of effects with live-action," noted Mark Malmberg, "such as the particulation shots and the shots where Jobe is in his cybergarden walking through this painterly scene that reflects his changing moods." For those shots, animator Henry Preston used some of Xaos' most highly developed image processing software. Nearly all such processes are done on the two-dimensional plane, although Malmberg refrains from referring to it as such. "What we do is more appropriately called pixel-based animation, and a lot of it uses three-dimensional concepts. We store 3-D information as image channels and use 3-D lighting models. So we take images, derive 3-D information from them and apply the lighting to the surface."

Xaos also uses pixel color and position information from live-action footage to act as forces in driving their particle system. Thus, over time, colors lead to other colors as their positions shift

about. And when the moving color blobs bump into other blobs, they interact. In doing so, the particle system leaves trails that paint the output images, creating the type of fluid effect seen in the dreamy cybergarden scene. Then a technique known as 'reflection mapping' comes into play, in which a preexisting image of an environment is digitally projected onto an object in such a way as to make the object look like it is mirroring its surroundings. "In the garden scene," noted Malmberg, "Henry Preston used a bluescreen element of Jobe, which was treated as a 3-D surface, and reflection-mapped it with the background plate which we derived from live-action processed with the pixel animation. So as Jobe walks around, he's reflecting what's surrounding him."

Jobe informs Angelo that he plans to merge completely with the virtual world, then enter the real world's communication systems and computers to become an all-powerful cybergod. Moments later, the house is surrounded by VSI agents who open fire on a gigantic golden head that Jobe manifests in the sky. Reflection mapping was used on the head; and light refraction was also simulated. "I refracted the background through the face based on the luminosity," animator Tony Lupidi stated, "then I lit it with golden light. You can actually see the gunfire flashes in the reflection if you look closely." One of Lupidi's favorite scenes wound up on the cutting room floor. Originally, the script called for Angelo's wife (Colleen Coffey) to be killed by the VSI gunmen. In the deleted scene, the dead woman's face — seen from Jobe's VR-distorted point of view — looks like a lumpy puddle on the floor. The process used was similar to the golden head, only heightened natural colors were mapped on and the flattened face was stretched out in perspective. "It was a disturbing image, with a deranged look. Brett said it was the weirdest shot in the film."



When agents from VSI attempt to capture him, Jobe employs his mental powers to dissolve the men into tiny spherical blobs that swirl about furiously and then scatter into oblivion. The effect was produced at Xaos using a particle system to create the hundreds of spheres that were then texture-mapped with imagery derived from the live-action plate photography.

Jobe uses his mental powers to dissolve the assailants into swirling blobs of flesh which he then scatters in all directions. A particle system was used by Ken Pearce to turn the agents into hundreds of ping-pong-ball-sized spheres, texture mapped with appropriate colors from the live-action plate. At first, the balls are so flat and seamless that they are invisible and the shot looks just like the live-action. Then they start to inflate and vibrate with pseudo-Brownian motion, swirling with increasing speed until they explode apart recursively. "Our software is

different from most," said Pearce, "in that it not only has all the usual animation tools, but it also has tools that let you create new tools. You can invent things with the program, and the ping-pong ball scenes are an example of that. All I really did was make the texture map coordinates so that each ball knew where it should look on the source image for the picture information. It's kind of a big old recursive particle system. Once the balls start to inflate, the lighting changes to make them show up as dimensional with highlights."

In a scene cut from the film, Angelo's wife is killed by the VSI assailants. Xaos rendered the dead woman's face, as seen from Jobe's VR-distorted point of view.

Having dispatched his enemies, Jobe barges into the cyberlab where he makes good on his promise to abandon his corporeal form altogether and enter the cyberworld forever. Unfettered by mortal constraints, Jobe fashions his own cyberform and environment within the VSI computer.

Pearce had a problem controlling the randomness without making the particles look too controlled. "I had to walk the line between having the balls ordered versus random. They were supposed to move randomly, and yet spin around three times and blow away. That actually required quite a bit of work. Then there was an interesting shot where one of the guys opens up his shirt. His hands and shirt are particulating, but inside the shirt the action is different. We called it the 'meat vortex,' because I tried to make it look like blenderized lamb chops. The compositing was easy because the actor was photographed with some blue foamcore under his shirt. But I had to whip all these particles together — like making things jump through hoops and getting them to behave right. We thought about having just his body particulate, and not the clothes — which we could have done by rotoing the clothes — but then we would have had a problem when he blew away. We'd have had to do a practical shot of the clothes deflating." A similar particulization sequence occurs somewhat later when Jobe gets even with Timms. Unlike the gunmen, however, Timms is not totally destroyed by the process. Instead, he keeps swirling apart and then back together.

Sound effects for the sequence, and the film, were designed by Frank Serafine who also created digital sound environments ten years ago for Disney's landmark computer graphics film, *Tron*. Serafine used a large assemblage of digital and analog synthesizers interfaced with six Macintosh computers and output to a mixing console and recorders at his Venice sound studio. In addition to the large library of sounds he has sampled over the years, such as the high-voltage sparks of a Tesla coil he originally used in *Tron*, he used a DAT recorder to tape noises like street traffic and the squeal of a shortwave radio being tuned. Unlike most assignments, the VR ambience of *The Lawnmower Man* called for synthetic rather than natural sounds. For the flying 'Cyberboogie' game, he created a rocket sound by combining real jet engine noise with the sound made by setting fire to the spray from an aerosol can which was then detuned several octaves. To Serafine, Xaos' particulization death scenes suggested molecules spinning around and striking one other, so he sampled some billiard balls colliding and then processed those sounds on his Eventide H3000 harmonizer. This was combined with the sizzle of a deep-fat fryer and an air shredding sound he obtained by whipping long strands of wire around his head.

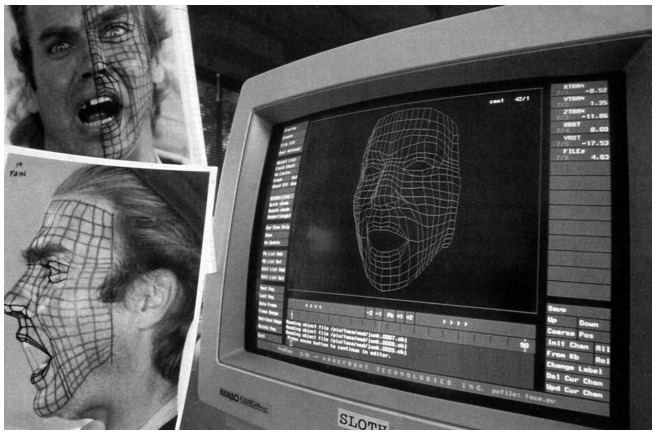
Except for the fiery death of Father McKeen, the compositing of all the animation with live-action, as well as most of the straight live-action bluescreen shots, was done on digital tape next door to Xaos at Western Images whose credits include commercial spots for McDonald's and The Disney Channel and postproduction effects on The Young Indiana Jones Chronicles. "We're digitally linked

up to Western with a feed that goes down through our basement and up into Western's machine room," Malmberg related. "With that tie-in, we can fire stuff back and forth to their Quantel Harry (digital editing and compositing system) and their D-1 (digital tape) recorders."

Western's vice president and director of visual effects, Jonathan Keeton, supervised the compositing while Jimi Simmons did most of the hands-on Harry work — particularly for Jobe's skewed POV as he sits in a diner and first realizes he can read minds. "We broke the image down into its red, green and blue components," said Keeton, "and we did a separate move for each channel. Basically, we yanked the image apart and then slowly put it together again to get the original full-color image. The other thing we did to it was create various moving patterns digitally." The actual scanning of the live film footage for transfer to digital tape for Western — and back to film again after the compositing and effects were finished — was done using the Gemini process at The Post Group in Los Angeles. Getting back to film is the interesting part. The color components are each scanned out separately in black-and-white and then combined through RGB filters onto a single piece of film — much like the old Technicolor process. Additional conventional opticals and titles were provided by Perpetual Motion Pictures.

Western Images also created menu screens for the chimp's infrared cyberhelmet POV featured in the scene when he is escaping from the lab. These readouts include X-Y-Z coordinates and vectors to acquired targets. "We didn't have a lot of time," said Keeton, "so we just had to imagine what it would be like to look through one of these helmets — if you were a chimpanzee! So we used the paint system and the Harry to do image manipulation. For scenes where the chimp is looking though walls, the heat signature stuff was some kind of thermal imaging that Brett shot on 3/4-inch and we then processed." The principal graphics in the cyberhelmet consisted of an X-Y-Z coordinate system apparently showing the position of targets, and an audio waveform in a box on the upper left. "Actually, the X-Y-Z thing was a device we have on our digital video effects units to show where things are — we just stole it! Anybody who works in this business will recognize it."

At Angel Studios, animation director Michael Limber confers with creative director Jill Hunt and software developer Brad Hunt over storyboards for the film.



The end sequence required Angel to produce a quasi-lifelike representation of Jobe in the VR world of his own making. To model the 'CyberJobe' character within the computer, grid patterns were painted on to Jeff Fahey's face, then photographed from different angles as the actor

Having dispatched the gunmen, Jobe proceeds to the cyberlab to accomplish his goal of melding with the digital world. Aware of his intent, Angelo tries to prevent him from assimilating himself into the worldwide computer network by closing off VSI's computer links to the outside. Jobe disperses a squad of guards at the facility's main gate by materializing a swarm of firefly-wasps to attack

them. The CG insects were animated at Angel Studios by Jeff Hayes using Brad Hunt's special program particle system in yet another, very unusual application. "The particle system behavior was to follow a certain path with a mean invariance depending on how agitated the swarm of five to ten thousand bugs was," said Hunt. "Instead of particles, what was placed there were single flat polygons, and on each polygon we texture-mapped CG footage of a bug. First we animated a short sequence of a bug flapping its wings and being aggressive. Then we mapped it onto the thousands of separate polygons. In the foreground, in some of the scenes, we had a high-detail 3-D bug come out of the swarm and attack. That gave the impression that every bug was high-detail. This was all bluescreen material composited at Western Images with a lot of Harry work to embellish it with shadows."

expressed a wide range of facial emotions. Fahey was also photographed mouthing different phonemes to assist the animators in creating a convincing representation of speech. Prints were then made and the grid coordinates digitized by hand to build a three-dimensional representation of the actor in computer space. Facial details and coloration were applied later.

Angelo gets to the building shortly after Jobe and places explosives in a number of strategic locations. In the cyberlab, he finds Jobe strapped into the gyrosphere. All that is left of his physical form is a shriveled husk — created by makeup artist John Buechler of Magical Media Industries — for Jobe has already become one with the electrons in the computer. Putting on a cybersuit and jumping aboard the other gyrosphere, Angelo follows Jobe into the VR world.

In general throughout the movie, each new VR scene has a little more visual complexity than the one before it. This time, after Jobe flies down into an orange whirlpool and comes out the other side, his golden cyberform has a full-color face. In a rage, a blue corona discharge transforms him, replacing his plain gold skin with an electronic circuit pattern texture map. Discovering that his link to the outside has been severed, Cyber-Jobe — as the character was christened — tries frantically to find an in/out port to escape the computer.

The initial CyberJobe scenes were done at Angel Studios by Michael Limber. "It was a real challenge in that I was replacing an actor — not that the Screen Actors Guild needs to worry quite yet — and a challenge also to keep it all looking consistent, especially the facial expressions. There's a learning curve in anything you do, but you don't want it to show up in the work. We had to make it look like Jobe's consciousness was within this computer generated character."

To model CyberJobe's face within the computer, a grid pattern was painted on Jeff Fahey's face, then photographed from several angles. The grid was subsequently digitized by hand from prints. "The coolest thing," Brad Hunt recalled, "was refining the facial expressions for Jobe — getting them into the computer and building something we could use to create dialogue without having to spend years animating. Physical details, including eyes and teeth, were individually modeled by animator Paul Lewis and applied to the refined facial models, along with skin texture taken from a color photo."

"We concentrated on creating a synthetic actor with highly detailed facial expressions," Jill Hunt elaborated. "We took lots of pictures of Jeff Fahey going through all the different vowels, consonants and phonemes, and with different expressions on his face. Any expression could be mixed with any vowel or consonant. Then we just set one sound next to the other and the computer could interpolate between the two. We used an audio track to extrapolate the exact timing of each

phoneme. I would exaggerate to emphasize certain words, like in classical animation." Once inside the VR world, Angelo finds himself powerless before his abberant creation. At one point, he is literally crucified when CyberJobe reads his thoughts and learns about the bombs he has planted. Jobe frees the doctor, however, when he realizes that his friend Peter is in the lab building and must be delivered to safety. "When Jobe discovers that Peter is in danger, he struggles with his humanity. He not only shows it in his face, but changes back and forth from a digital circuit-man to his more human, golden cyberform."

Angelo is released from the cyberworld to save Peter. As the seconds tick down, CyberJobe frantically searches for a data channel out of the doomed computer. Just as the explosives start to detonate, he discovers an accessible channel of escape. The last computer graphics effect we see is of the character disintegrating into a polygonal particle system and shooting down the in/out port in a blur. "We changed his gamma (color) as he changes to pure energy," Jill Hunt concluded. "It was fun playing with the colors. So much of the creative process goes beyond animation and involves continual experimentation with color and lighting."

Angelo and Peter race to escape the holocaust as the explosives planted earlier begin to detonate. David Stipes Productions was contracted to orchestrate the destruction. In the interests of economy, miniature effects supervisor Tony Doublin — a veteran of 1941 and The Re-Animator — made all the models needed to replicate the interior stage sets and the location exterior at the Brandeis Institute in Simi Valley with a minimal crew of five. "We told the producers that if we could have lots of time to avoid a back-end rush and keep the crew costs down, we could meet their budget. The only time we actually had a crew was for the week when we shot the models. The production had built sets on stage with futuristic rooms and corridors, so we built miniatures of these sets for fireballs and explosions. Brett wanted these fireballs to come all the way up the length of the corridor. To facilitate that, we built our miniature on a trussed-out base so we could stand it up almost vertically and lean it against the roof of our building. In effect, that turned it into a chimney — heat rises. The main unit shot some live scenes with air mortars going off around the actors which were intercut with our work. Our job was to match their live-action lighting, so it would cut together well." For explosions in the main lab, Doublin and his crew rotoscoped a film clip of the stage set and then made miniature cutouts of the pillars and computer equipment from pieces of foamcore and plywood which were then covered with black velvet. The pyrotechnic explosions wrapped around the silhouette shapes and created a convincing effect when superimposed over the live-action plate material.

"For our big shot, we recreated the exterior of the lab from one angle in miniature and blew the ever lovin' out of it for the grand finale. The building was a cluster of cylinders nesting within each other, so there was nothing but curved surfaces on the side we were photographing. The model was twelfth-scale, twenty feet across and twenty-nine feet deep, with the tallest cylinder a little over five-and-a-half feet. It was on a four-foot table with a sloping landscape leading up to it. During the shoot, we did a split-screen with our model on the top of the split, so it looks like the building is exploding and the actors are being knocked to the ground by the concussion. We did night exteriors in our parking lot for about a week. We were running two cameras with a crew of six, plus a standby painter and two standby modelmakers — not counting Frank Ceglia, the pyrotechnician, and his assistant. The model had been built in conjunction with the pyro guys, to be sure that what we built

they could blow up. If you build your model too well, the pyro needed to blow it apart ends up vaporizing it; so you have to build it just weak enough to get a good-looking explosion."

Angelo enters the cyberworld in an attempt to dissuade Jobe from taking control of the worldwide computer network. His pleas are met with hostility.

Having learned that Angelo has planted bombs in the lab to destroy the computer, CyberJobe crucifies his former benefactor.

Although efforts were made to create a very detailed likeness of Jeff Fahey in the computer, Angel Studios animators often exaggerated his expressions to heighten dramatic effect.

The Lawnmower Man will certainly introduce a lot of people to the concept of virtual reality, so it should be emphasized that the complexity of the computer graphics imagery shown in the film is a long way from being a reality — virtual or otherwise — at least with contemporary systems. Multimillion-dollar super-computers aside, there is at present simply not enough computer power available to make the polygon counts high enough or the rendering rich enough to approximate in real time the painstakingly produced animation featured in this cinematic excursion. Not today, perhaps — but it will happen. Before long, the interactive experience will doubtless prove so superior to other ways of using computers that many tasks — office work, for instance — will start to be done using eyephones and Data-Gloves. Even for the struggling writer, the idea is seductive — lying back on a couch, 'typing' in the air using the gloves, moving through a 3-D text space by pointing and grabbing words and sentences to move them around. It would be a much more intuitive and creative process than working with a blinking cursor one screen at a time. And infinitely more fun!

As the explosions commence, CyberJobe searches frantically for an open data channel out of the doomed computer.

For exterior shots of the blast, the lab location was duplicated in miniature at David Stipes Productions. A small crew working under effects supervisor Tony Doublin created the twelfth-scale model which was rigged with pyrotechnics and detonated in the facility's parking lot Selected interiors were also reproduced in miniature.

It is likely that virtual reality will eventually become the hub of all forms of media-based work and play. It may be a few decades before *Star Trek*'s 'Holodeck' is a reality; but in the near future, we can expect things like a virtual travel agency that lets us walk down the streets of Paris, a biology program so we can experience life as a dinosaur and 'games' for exploring the moon and Mars using NASA terrain data. Expect the unexpected from the synergy when everything ties together, when VR is augmented with speech recognition, artificial intelligence and fiberoptic phone lines linking us with people from all over the world. A virtual global society is coming where everyone will not only work together, but create adventures, share ideas and just plain party.

"Some people try to categorize virtual reality as just one thing," Brett Leonard concluded, "but that's like saying the internal combustion engine is just one thing. That invention obviously spawned many, many technologies. I expect virtual reality to do the same. VR is just a base level technology that will spawn an incredible cultural revolution in the man-machine interface, affecting how we live our everyday lives from A to Z. It's going to impact on everyone as we move towards the turn of the millennium. Who knows where it will stop?"

The Lawnmower Man photographs copyright © 1992 by New Line Cinema. All rights reserved. Production unit still photography by Suzanne Tenner. Additional photographs courtesy of Angel Studios, Western Images, Homer & Associates, David Stipes Productions and Xaos, Inc. Special thanks to Lisa Sontag and Linda Jones.

COMMERCIAL SPOT: WIDEBODY WHALES

article by Jody Duncan

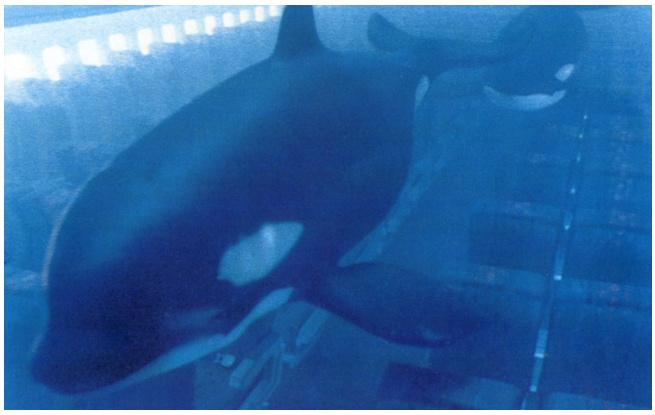
Creative minds at the Leo Burnett USA agency had come up with a striking idea for their client, United Airlines. Using a whale's annual migration as a metaphor for the ease and comfort of long-distance travel aboard a United 747, the agency had envisioned a commercial that would depict killer whales swimming gracefully inside the jetliner. United was enthusiastic about the visual impact such a commercial would make, but had understandable doubts about its execution. How do you get killer whales to swim inside a 747?

Because of its solid reputation in visual effects, Boss Film Studios was considered a likely candidate to address that central question. Prepared with detailed storyboards, the agency contacted Terry Windell an effects veteran and commercial director at the facility. "They knew exactly what they wanted," recalled Windell, "but they didn't know whether or not it could be done. United wouldn't go for it if it wasn't executed perfectly; so our first job was to convince everyone that we could pull it off." Windell presented United with a Boss effects reel, along with a slide show illustrating examples of their work from storyboards to finished product. Though impressed, United did not commit wholeheartedly to the project until Windell produced a video animatic of the proposed commercial. "The animatic gave them an idea of the potential of this thing — how elegant and beautiful a commercial it could be. They got very excited about it at that point." What Windell proposed was to build mechanized whale miniatures, mount them on a motion control modelmover and shoot them in a specially lit smoke environment that would simulate water. United agreed to the approach, and Windell and his crew began work on the miniature whales that would star in the forty-five-second spot.

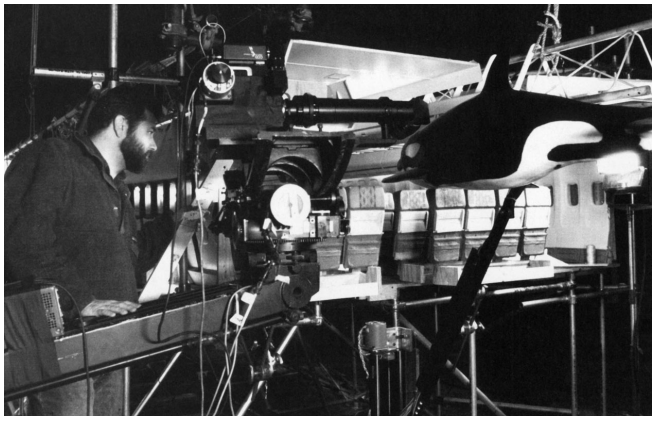
As fantastic a concept as two whales swimming inside an airplane was, reality still dictated parameters for the miniature construction. Since two adult-size killer whales would not actually fit inside the cabin of a 747, the dimensions were based on twelve- to fourteen-foot adolescent whales. Two full-body models and one closeup head section were built in approximately one-third scale. To be convincing, the models had to look and move exactly like real killer whales. After a detailed sculpture was completed by Mike Hosch, molds were made and skins were run by Mark Garbarino out of Skinflex — a urethane especially well suited to underwater creature effects — and then painted. Constructed out of aluminum and steel, the inner core of each whale was supported by a fiberglass substructure.

Tom Quinn — who had worked at Berkshire Ridefilm as part of a team that built a fully mechanized tyrannosaurus rex — was given the task of engineering the complex mechanics. In addition to creating fluid movements, the whale mechanisms had to be motion controlled and fully repeatable. "One of the things we had to decide in the beginning was how many axes of movement these things could have and what they could actually do," Windell commented. "Of course, as a director, I wanted them to do everything. But it was a matter of how many mechanical devices we could fit inside a three-foot-long body."

Ten channels of motion were ultimately incorporated into each whale. Particularly demanding was the tail mechanism. “Since we were going to be shooting dry-for-wet, it was important that we be able to simulate the resistance of water on the tail, the deflection of the fluke as the tail strokes up and down. We had to build that deflection in, which was one of the most difficult tasks. The tail area was quite thin — only about a quarter-of-an-inch thick — so getting any kind of mechanics in there was next to impossible.” Quinn solved the problem by building a segmented tail. The flukes were rigged with spring steel and minute cabling which ran to the tips. “Tom engineered a series of cams and motors that would allow the tail to make the deflecting motion. On top of that, the whale could tilt its head up and down, left and right, move its pectoral fins up and down and roll each pectoral fin individually. We also had the prime body arch up and down to make it look as if it was swimming.”

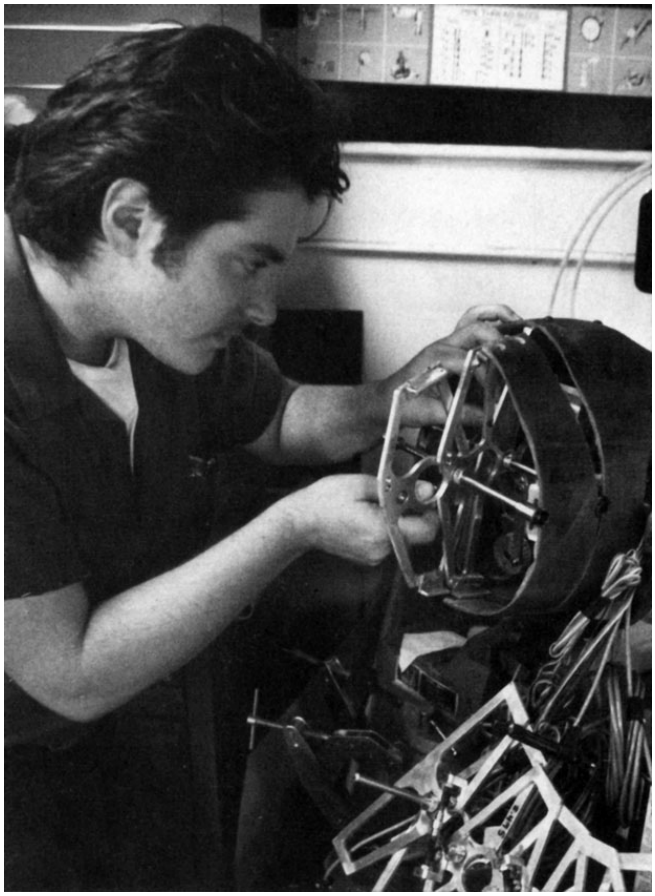


Killer whales swim through a 747 jetliner in a United Airlines commercial produced at Boss Film Studios.



Motion control whales were filmed inside a model aircraft which was smoked to simulate an aquatic environment Director Terry Windell studies the setup on stage.

The completed models were mounted on a motion control modelmover that provided the whales' tracking moves. "Each of the whales was mounted on its right side, right in the center. Not only did we have these steel mounts to deal with, but we also had umbilical cords coming off of them for the mechanics. Fortunately, most of the shots were designed so that the mounts and cords could be easily hidden." Animator Laine Liska wrote a basic motion control swim program based on the storyboards. "There were nine programs, and I extracted the two that I thought were the most convincing swims. I worked with motion control cameraman Harry Alpert, writing modifications on those programs to groom the whales for each particular shot. It was quite complicated — if we made even a tiny change on one axis, it affected all the other axes."



Mechanisms for the whales were engineered by Tom Quinn.

As vital as the whales were to the commercial, the real star — at least as far as United was concerned — was the 747 itself. Model shop supervisor David Jones and crew chief Pat McClung built a third-scale miniature of the airliner with slots down the aisles to allow passage of the whale mounts from beneath. "We couldn't get plans of the airplane," noted Windell. "Boeing — who builds the 747 — is very leery when you call up and say, 'We'd like to see detailed plans of your plane.' So we had to take a crew out to the airport and measure everything, and then scale those measurements down. We set up an assembly line for the construction, mass-producing the repeating sections of the interior. The completed miniature was more than twenty feet long."

The smoke levels and lighting setups needed to simulate an aquatic environment within the plane were established during a two-week period in which Windell and cinematographer Dave Stewart shot numerous film tests. Stewart — no stranger to the dry-for-wet approach, having worked on both *The Abyss* and *The Hunt for Red October* — was instrumental in creating the watery ambiance. Once the basic approach was pinned down, Windell and Stewart began the actual photography. Multiple motion control passes were required. "We would shoot a pass on the miniature airplane, then a pass on the whales in smoke, and then a water ripple pass. We were actually backwinding the camera, so these passes were being burned in on top of each other — which I think produces a better quality than building a shot up in composite." An extra pass was required for two scenes in which the whale mounts were visible. "We put a bright yellow card on the mounts so we could extract the yellow and slide a background image into that area, then do a little blend around the edges."

Computer graphics supervisor Jim Rygiel and programmer Colin Olson enhanced the completed shots with computer generated bubbles. “The bubble program really solidified the idea that we were underwater. There were tiny bubbles that would react a little bit as the whales swam by, and larger foreground bubbles that you always get when you’re shooting underwater. There were also some bubbles coming out of the whale blowholes and climbing up the sides of the windows.”

After five months — an extremely generous schedule for a commercial — Boss delivered their completed shots. Both United and the Leo Burnett agency were more than satisfied with the final spot, which debuted in February during the broadcast of the opening ceremonies of the winter Olympics. “It was more ambitious and took longer than a typical commercial,” Terry Windell concluded, “but I think they felt the result was worth the time and trouble.”

COMMERCIAL SPOT: REFLECTIONS OF THE DEAD

article by Janice Hubbard

It's the party you've always wanted to attend. Everyone is there — I mean everyone!

Elton John is at the piano, surrounded by gorgeous men and women laughing and talking and drinking nonchalantly. Our attention shifts to the entryway, where in walks a man who looks an awful lot like Humphrey Bogart. Humphrey Bogart? It must be a look-alike. He speaks, and there is no mistake — it's Bogie for sure. But wait a minute, isn't he …? The hostess laughs and turns to seat him. Elton continues, waxing melodic. Diet Coke cans are everywhere, red, white and moist. Before long, the partygoers are joined by a dapper James Cagney; and the one and only Louis Armstrong sits in on trumpet. In a scene neither of them could have ever envisioned, Bogart and Cagney are at separate tables, ensconced in the modern setting and interacting with people who were children, or unborn, when they were still alive. And when it all ends, attentive television viewers are left wondering: "How did they do that?"

Ask Bob Greenberg. It was his New York effects house, the prestigious R/Greenberg Associates, that pulled off the casting coup of the decade. Using archival footage from old movies, Greenberg and his team were able to use cutting-edge digital technology to resurrect three deceased superstars and place them in a contemporary soft drink commercial.

The concept for the unique spot originated with Lintas:New York, the advertising agency for Diet Coke, which also secured rights to the borrowed footage and hired director Steve Horn and supervising editor Dennis Hayes. To realize the concept, some one hundred classic films were examined for usable clips — a process which yielded material from three different decades: shots of Humphrey Bogart from *All Through the Night*, Louis Armstrong from *High Society* and James Cagney from *The Public Enemy* and *The Roaring Twenties*.

The Diet Coke commercial was not R/Greenberg's first occasion to manipulate archival footage. In *Zelig*, they had done much the same thing, only in reverse, incorporating contemporary photography of Woody Allen into vintage newsreels with historic figures. "You think these effects are throwaways," observed Greenberg, "but they're not. The eye sees them and tells you if they are right — or 'kosher,' as Woody Allen puts it. Unless you go into all the depth of detail, it just doesn't feel right."

For the 'Nightclub' spot, the detail was obtained via a digital video process than began with a pin-registered transfer of the original footage. "We had to study each of the black-and-white scenes," said visual effects supervisor Ken Eyring, "which is a frame-by-frame process, because when the old footage got transferred, there was a very slight weave to it. So before we could even do the rotoscoping to make the mattes, we had to make sure that each frame was registered precisely to the previous frame. It took one person eight days to steady eight scenes."

Once the imagery was stabilized, the footage went to motion control cameraman Ed Manning whose job it was to figure out precisely what the original taking cameras were doing during the

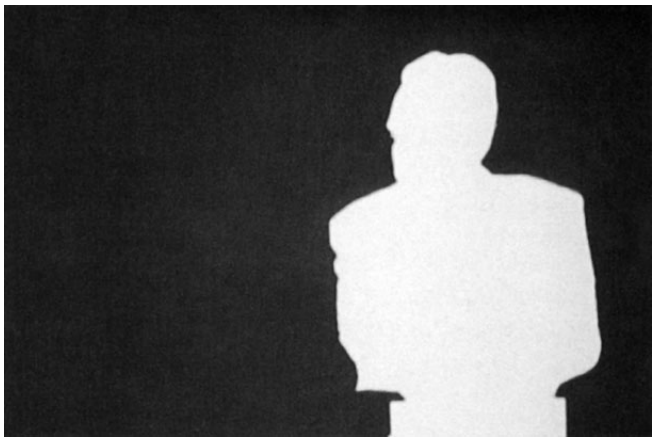
scenes. “I had to reconstruct camera moves from fifty years ago based solely on what was there on the film. But with the motion of the camera through a scene, and with the changes in parallax and things like that, there was actually a surprising amount of three-dimensional data. The tricky part was determining what part of the motion in the vintage film footage was due to pan and tilt and what part was due to actual physical movement of the camera.” Once isolated, the motion data was recorded for later playback by the camera used to photograph the contemporary material.

Several rotoscoping techniques were used to extract the three performers from their original environments. “Because of the enormity of the project and the extremely short schedule,” said Eyring, “we approached the rotoscoping from three different directions simultaneously. Animator Steve Marino did traditional rotoscoping on the animation stand while video editors Paul Agid, Michael Nicholas and Burtis Scott did electronic rotoscoping in two different ways using a digital video paint system and custom techniques developed specifically for this project.”

The next step was marrying the archival icons into the new scenes shot with the prerecorded motion control moves. Though larger than life, both Cagney and Bogart were short in stature compared to the statuesque models hired to appear in the contemporary footage. Consequently, some adjustments were required. “We had to make the icons a little bigger,” stated effects producer Nancy Bernstein, “because the Cagney and Bogart sightlines were always in the wrong place. Cagney was looking right at one model’s … chest. So we had to resize both Cagney and the model. It was very important to make sure the characters were looking at each other.”

Extensive rotoscoping and digital effects, including colorization, were employed by R/Greenberg Associates to extract actor James Cagney from one of his vintage black-and-white films and incorporate him into a contemporary nightclub setting for a Diet Coke commercial.

Each scene was pieced together in layers. There was a background layer of people seated and dancing, a middle layer with the archival characters and those interacting with them, and a foreground layer of people crossing that was used to give the icons a context of ‘reality’ in which to be grounded. “When Louis Armstrong is playing with Elton John,” Bernstein continued, “you don’t really notice the foreground people, but they give the shots a sense of depth. Steve Horn wanted a lot of activity in order to create a convincing scene for the archival characters to participate in. Since blue was going to be a dominant color in the actors’ wardrobe, we shot the added layers with a green screen.”



Extensive rotoscoping and digital effects, including colorization, were employed by R/Greenberg Associates to extract actor James Cagney from one of his vintage black-and-white films and incorporate him into a contemporary nightclub setting for a Diet Coke commercial.

In order to make the vintage actors look as if they belonged in their new surroundings, all of the lighting cues were taken from the archival footage. “Steve did a great job of analyzing the lighting on the original cinematography,” said Eyring. “If there was a key light on the right side, he would put a key light on the right side when we set up the stage for the other layers. A shadow across Bogart’s jacket looks as if it was thrown by the hostess, but it was actually from a man in the original picture. So the placement of the hostess and the lighting were actually dictated by the existing shadow.”

In the planning stages, no one was sure which way to go with the black-and-white footage. Every possibility was examined, from doing the commercial entirely in black-and-white, to using color footage with black-and-white icons, to going totally with color — which was the final choice. This decision was due in part to the in-house colorizing that Michael Nicholas, in digital postproduction, did as an experiment to compare with footage that had been sent for testing to a California colorizing house. “As it turned out,” Eyring said, “everyone who saw it thought that ours looked better, including the agency. It was good that we were able to do the work, because it allowed us to put the black-and-white footage into the scene and then colorize it — keeping it within the digital domain so there was no degeneration from the composite scenes to the strictly live-action scenes. By doing that, we were able to save three generations of one-inch tape duplication that would have been necessary due to the processing restrictions posed by the colorizing houses. Even with the natural degeneration of the archival footage — which was not original negative — there was no jump in the quality at all.”

Finishing touches in digital postproduction gave the commercial the added flourishes needed to really sell the illusion. Cagney’s reflections in a table, for instance, were processed from the original footage and added digitally, as were Louis Armstrong’s

alongside Elton John's in the piano top. "Reflections of the dead," Bob Greenberg observed wryly.

Success breeds sequels, even in the commercial field. R/Greenberg is now at work on a second Diet Coke spot set to air in mid-June.

LASER REVOLUTION: LASERDISC MANIFESTO

column by David C. Fein

In every great film there is a particular point at which the viewer becomes an emotionally invested participant rather than just a passive observer sitting in a movie theater. The ability of the film to draw an audience into its story, creating a strong empathic response to its characters and situations, is not a simple accident. It is the result of the cumulative efforts of a company of artists who have poured their blood, sweat and soul into the production.

Until recently, the ambience of the theater itself was an integral part of the movie-going experience. High fidelity sound systems and large movie screens facilitated the audience's total immersion into the world of the film. The past decade, however, has seen a growing popularity of the home video experience. With recent developments in audio and video technologies, home audiences have to lose very little of the involving experience of the theater environment. Home *THX*, Dolby ProLogic Surround, large-screen television and artful transfers from film to video have made the home theater a reality.

The emergence of video technology, therefore, has added a new wrinkle to the creative process of making a film. Traditionally, the painstaking concern and care for every aspect of a film's production has ended — for better or worse — with the film's release. For decades, that was the end product. Today, however, after a film has completed its theatrical run — and occasionally even before — its preparation for subsequent video release begins. The importance of that aspect of a film's commercial afterlife should not be underestimated, because it is often the case that far more people see a movie on video than ever saw it in a theater.

Unfortunately, by the time a movie is transferred to video, the filmmaker has generally moved on to other projects, leaving the full responsibility for the transfer to the production company — which may or may not exhibit meticulous attention to the process. A poor video transfer can ruin the mood of a picture, or worse, completely invalidate many of the skillfully designed lighting and framing details. This is particularly alarming considering that, in many ways, the video version of a film will be considered a true representation of how the film was presented in the theater — video is, after all, the medium of record once the film leaves its theatrical forum. For this reason, the care lavished on the release of a film for the theater should be reasserted at the time of the video transfer. By taking an active role in the video transfer and release processes, filmmakers can ensure that their vision of the film survives.

During the filmmaking enterprise, visual effects generally garner more careful attention than any other shots in the production. Much of this effort can be instantly eradicated by an indifferent transfer to video. Imperfections such as residue from holdout mattes or a flat look from rear projection may become more evident in video than they were in film. In a good video transfer, such shots are adjusted, or even digitally altered, so that imperfections are less noticeable. In some cases, these adjustments can improve visual effects shots so that they are shown to better advantage in video than they were in their original theatrical release.

Another consequence of the home video explosion is that effects can now be observed and examined in great detail — detail that may have gone unnoticed and underappreciated in the past. Stepping through an effects sequence one frame at a time may reveal a wire or support the filmmaker hoped would go unnoticed, but it may also enhance a particularly striking image or complex bit of choreography that might otherwise have slipped by almost subliminally. In many pictures, effects scenes are cut in such rapid-fire manner that individual shots can barely be detected, let alone studied; and so, appreciating the artistry of a shot, or understanding how it was accomplished is virtually impossible via traditional viewing. Video, however, affords an opportunity to elicit that appreciation and understanding; and for hardcore students of film, or just the enthusiastic fan, this is one of its most appealing features.

Laserdics are especially well suited to careful scrutiny of a film, offering the best image and sound quality available to the home, as well as the best frame reverse and advance capability on the market. On laser, each frame is perfectly stable, and is not disrupted by annoying lines often visible when frame advancing on videotape. In addition, because of their superior quality, laserdiscs have been chosen by film artists as the favored medium in which to create special editions of their films. Freed of the time constraints placed upon them for theatrical release — either to complete the film or to deliver a print of a specified length — filmmakers may find an aesthetic freedom in creating these special editions that they could never have exercised under the pressures of film production. Moreover, many releases include supplemental materials in the form of original production artwork, theatrical trailers, visual effects test footage, outtakes, behind-the-scenes footage and still photographs, plus separate audio commentaries. In some cases, these special editions have included other materials carefully formatted and arranged to create a detailed documentary of the production. Not surprisingly, special editions have been extremely popular with laserdisc consumers, as well as serious film collectors; and more such releases are expected in the future.

The addition of supplements on laserdisc has provided a new and innovative way for all aspects of film production to be examined and cherished by future effects artists and filmmakers. Just as classic effects films of the past served as inspiration for many of today's practitioners, today's films will provide like inspiration for the next generation who will no doubt learn the basics of their craft by repeated frame-by-frame film consumption on a laserdisc system. In the coming years, we will see more filmmakers paying closer attention to the release of their films on video, as well as more extensive use of the format to document the history of their productions.

Laserdisc special editions and supplements provide a unique complement to the articles in Cinefex — all striving, in their own way, to present a fascinating and comprehensive investigation into the visual effects process. It is the goal of this column to evaluate the newest and best laserdisc offerings and to highlight those that may be of special interest to anyone intrigued by cinematic illusion.

David C. Fein collaborated with Michael Matessino on design and compilation of the special edition supplement for Aliens, widely regarded as a benchmark in the field of film enhancement via laserdisc. He is currently assembling supplement materials for a similarly expanded presentation of The Abyss.

INDEX 1-50

1:1 — “Into the V’ger Maw with Douglas Trumbull,” Don Shay (4-33)
1:2 — “Creating an *Alien* Ambience,” Don Shay (34-71)
2:1 — “Of Ice Planets, Bog Planets and Cities in the Sky,” Don Shay (4-23)
2:2 — “Greg Jein — Miniature Giant,” Brad Munson (24-49)
2:3 — “Star Trekking at Apogee with John Dykstra,” Don Shay (50-71)
3:1 — “Tauntauns, Walkers and Probots,” Paul Mandell (4-41)
3:2 — “Walter Murch — Making Beaches Out of Grains of Sand,” Jordan Fox (42-57)
3:3 — “The Microcosmic World of Ken Middleham,” Don Shay (58-71)
4:1 — “*Outland*,” Don Shay (4-31)
4:2 — “*The Altered States* of ‘*Altered States*,’” Paul Mandell (32-71)
5:1 — “Ray Harryhausen — Acting Without the Lumps,” Vic Cox (4-19)
5:2 — “*Clash of the (Foot-Tall) Titans*,” Don Shay (20-41)
5:3 — “Roy Arbogast,” Jordan Fox (42-53)
5:4 — “*Caveman* — The *Real* Stars,” Scott Vanderbilt (54-71)
6:1 — “Computer Imaging — An Apple for the Dreamsmiths,” Peter Sorensen (4-29)
6:2 — “*Dragonslayer*,” S.S. Wilson (30-61)
6:3 — “*The Wrath of God* &#xfffd; and Other Illusions,” Don Shay (62-79)
7:1 — “Willis O’Brien — Creator of the Impossible,” Don Shay (4-71)
8:1 — “Tronic Imagery,” Peter Sorensen (4-35)
8:2 — “*Silent Running*,” Pamela Duncan (36-67)
9:1 — “*Blade Runner* — 2020 Foresight,” Don Shay (4-71)
10:1 — “*Poltergeist* — Stilling the Restless Animus,” Paul Mandell (4-39)
10:2 — “Mach 5 Effects — The Apogee of Firefox,” Paul M. Sammon (40-71)
11:1 — “Turn on Your Heartlight: Inside E.T.,” Paul M. Sammon (4-49)
11:2 — “Special Visual Effects — Robert Swarthe,” Don Shay (50-71)
12:1 — “*Something Wicked This Way Comes* — Adding the Magic,” Brad Munson (4-27)
12:2 — “Stop-Frame Fever &#xfffd; Post-Animation Blues,” Paul Mandell (28-49)
12:3 — “A Dream in the Making,” Marc A. Richardson (50-71)
13:1 — “Jedi Journal,” Don Shay (4-67)
14:1 — “Low-Tech Effects — *The Right Stuff*,” Adam Eisenberg (4-25)
14:2 — “*Brainstorm* — Getting the Cookie at the End,” Brad Munson (26-49)
14:3 — “Shadow and Substance,” Don Shay & Paul Sammon (50-71)
15:1 — “David Dryer — *Never Say Never Again*,” Don Shay (4-27)
15:2 — “Waging a Four-Minute War,” Adam Eisenberg (28-49)
15:3 — “Photographs and Memories — Ralph Hammeras,” Don Shay (50-67)
16:1 — “Rick Baker — Maker of Monsters, Master of the Apes,” Jordan Fox (4-71)
17:1 — “*Ghostbusters*,” Adam Eisenberg (4-53)
17:2 — “*The Last Starfighter* — Imagery Wrought in the Total Forge,” Peter Sorensen (54-71)
18:1 — “*Hell and High Water*,” Robert P. Everett (4-41)
18:2 — “The Last Voyage of the Starship ‘Enterprise,’” Brad Munson (42-67)

19:1 — “Never Feed Them After Midnight,” Paul M. Sammon (4-43)
19:2 — “Across the Eighth Dimension with Buckaroo Banzai,” Nora Lee (44-59)
19:3 — “What Dreams Are Made of,” Adam Eisenberg (60-71)
20:1 — “Jupiter Revisited — The Odyssey of ‘2010,’” Adam Eisenberg & Don Shay (4-67)
21:1 — “The *Terminator*,” Jennifer Benidt (4-23)
21:2 — “The Shape of Dune,’” Janine Pourroy & Don Shay (24-71)
22:1 — “*Return to Oz*,” Brad Munson (4-41)
22:2 — “*Bringing Up Baby*,” Howard E. Green (42-67)
23:1 — “The Stuff That Dreams Are Made of,” Adam Eisenberg (4-33)
23:2 — “Baring the Soul of ‘*Lifeforce*,’” Glenn Campbell (34-53)
23:3 — “Shooting for an ‘A’ on ‘My Science Project,’” Stephen Rebello (54-71)
24:1 — “Creating the Wonder of ‘*Cocoon*,’” Jody Duncan Shay (4-37)
24:2 — “Backyard Adventures — Spielberg Style,” Janine Pourroy (38-67)
25:1 — “Behind the Lines of ‘*Enemy Mine*,’” Janine Pourroy (4-37)
25:2 — “Der Trickfilm — A Survey of German Special Effects,” Rolf Giesen (38-53)
25:3 — “*Fright Night*,” Jennifer Benidt & Janine Pourroy (54-71)
26:1 — “To *Hell and Back — Poltergeist II*,” Nora Lee & Janine Pourroy (4-35)
26:2 — “*Young Sherlock Holmes* — Anything But Elementary,” Jody Duncan Shay (36-67)
27:1 — “*Aliens*,” Don Shay (4-67)
28:1 — “*The Fly* Papers,” Tim Lucas (4-29)
28:2 — “Putting Big Trouble into Little China,” Janine Pourroy (30-49)
28:3 — “Building the Body Electric,” Jody Duncan Shay (50-67)
29:1 — “Humpback to the Future,” Jody Duncan Shay (4-31)
29:2 — “After the *Fall*,” Janine Pourroy (32-51)
29:3 — “Sky Wars,” Ed Martinez (52-67)
30:1 — “*The Care and Feeding of Audrey II*,” Jody Duncan (4-29)
30:2 — “A Question of Perspective,” Adam Eisenberg (30-45)
30:3 — “Of Daggers and Demons,” Paul Mandell (46-67)
31:1 — “*Spaceballs* — The Special Effects,” Mark Elliot (4-25)
31:2 — “Witch Trials,” Adam Eisenberg (26-45)
31:3 — “*Masters of the Universe*,” Ron Magid (46-67)
32:1 — “*Shooting RoboCop*,” Paul M. Sammon (4-41)
32:2 — “*Inside* Martin Short,” Janine Pourroy (42-67)
33:1 — “007 x 4 — John Richardson,” Nora Lee (4-23)
33:2 — “Aging Gracefully with Dick Smith,” Jody Duncan Shannon (24-51)
33:3 — “*Predator Revealed*,” Paul Mandell (52-67)
34:1 — “Cheap and Cheesy and Off-the-Cuff,” Jody Duncan Shannon (4-43)
34:2 — “Visit from a Small Planet,” Richard Linton (44-67)
35:1 — “Romancing the Rabbit,” Adam Eisenberg (4-33)
35:2 — “*Willow*,” Jody Duncan Shannon (34-67)
36:1 — “A Planetful of Aliens,” Ron Magid (4-17)
36:2 — “Exaggerated Reality,” Adam Eisenberg (18-31)
36:3 — “Double Vision,” Don Shay (32-49)

36:4 — “The Right Blob for the Right Job,” Robert G. Pielke (50-67)
37:1 — “Special Effects — *The Next Generation*,” Glenn Campbell & Donna Trotter (4-21)
37:2 — “On *the Fly* — The Making of a Sequel,” Robin Brunet (22-45)
37:3 — “From Science to Showbiz,” Pamela Duncan Looft (46-67)
38:1 — “The Adventures of Terry Gilliam,” Paul M. Sammon & Don Shay (4-67)
39:1 — “Dancing on the Edge of the Abyss,” Don Shay (4-79)
40:1 — “*Ghostbusters Revisited*,” Adam Eisenberg (4-45)
40:2 — “Father, Son and the Holy Grail,” Adam Eisenberg (46-67)
41:1 — “A Dark and Stormy Knight,” Jody Duncan Shannon (4-33)
41:2 — “Backyard Odyssey,” Susan Dayton (34-67)
42:1 — “The Thrill of the Hunt,” Mark Cotta Vaz (4-21)
42:2 — “Beneath Perfection,” Jody Duncan Shannon (22-45)
42:3 — “*Star Trek V* — Sharing the Pain,” Paul Mandell (46-67)
43:1 — “Ego Trip,” Paul Roberts (4-33)
43:2 — “Back to Back to the Future,” Jody Duncan (34-67)
44:1 — “‘*Ghost*’ Stories,” Jody Duncan (4-21)
44:2 — “Crimestoppers Textbook,” Glenn Campbell (22-51)
44:3 — “Playing with Fire,” Kevin Martin (52-67)
45:1 — “Wings of the Intruder,” Bill Norton (4-23)
45:2 — “Clash of the Robotitans,” Jody Duncan (24-45)
45:3 — “Maximum Impact,” Mark Cotta Vaz (46-63)
46:1 — “Rick Baker Revisited,” Ron Magid (4-29)
46:2 — “Through the Proscenium Arch,” Janine Pourroy (30-45)
46:3 — “Death and Aging — A Corleone Chronicle,” David Morgan (46-59)
47:1 — “A Once and Future War,” Jody Duncan (4-59)
48:1 — “Standing the Heat,” Jody Duncan (4-19)
48:2 — “Rocket Blast,” Mark Cotta Vaz (20-45)
48:3 — “That Old Black Magic,” Kevin Martin (46-59)
49:1 — “*Return to Neverland*,” Mark Cotta Vaz (4-23)
49:2 — “Borrowed Flesh,” Jody Duncan (24-39)
49:3 — “Letting Slip the Dogs of War,” Kevin H. Martin (40-59)
50:1 — “Zealots and Xenomorphs,” Bill Norton (26-53)
50:2 — “Cyberworld,” Peter Sorensen (54-71)

A full and comprehensive index to our first fifty issues would require a separate volume spanning a hundred or more pages. We offer, instead, an abbreviated compilation which we trust will be useful to researchers. The first section lists all of our articles by title, together with authors’ names and page numbers. Each article has a numerical identifier indicating the issue in which it was published and its placement therein. The second section (commencing below) is an alphabetical listing of film titles, individuals, effects companies and selected subject areas. Identifiers following each entry correspond to the articles listed in section one. Film titles have been limited to those receiving noteworthy coverage in the magazine. Individual listings generally specify those persons interviewed for a given article, although in some instances major references to an artist may be

listed even if the artist has not been quoted. Listings of effects houses reflect those companies that have made significant contributions to the subject film or films.
Abel, Robert — see Robert Abel & Associates
Abyss, The (1989) 39:1
Adventures of Baron Munchausen, The (1989) 38:1
Adventures of Buckaroo Banzai Across the Eighth Dimension, The (1984) 19:2
aircraft effects 2:2 / 10:2 / 12:3 / 14:1 / 18:1 / 29:3 / 33:1 / 36:2 / 40:2 / 41:1 / 44:3 / 45:1 / 45:3 / 48:2
Albiez, Peter 31:1
Alexander, Richard 8:2
Ali Baba Goes to Town (1937) 15:3
Alien (1979) 1:2 / 6:1
Alien Nation (1988) 36:1
Alien 3 (1992) 50:1
Aliens (1986) 27:1
All Effects 28:3 / 36:4
Allard, Eric 28:3 / 36:4
Allder, Nick 1:2
Allen, David 5:4 / 12:2 / 14:3 / 26:2 / 34:2 / 35:2 / 41:2
Allen, Ken 39:1
Altered States (1980) 4:2 / 6:1 / 16:1 / 37:3
Alterian Studios 48:3
Alves, Joe 4:2
Always (1989) 44:3
Amadeus (1984) 33:2
Amalgamated Dynamics 42:2
American Graffiti (1973) 3:2
American Werewolf in London, An (1981) 16:1
amusement parks — see theme park applications
Anderson, Clark 45:1
Anderson, Peter 22:2
Anderson, Scott 42:1
Angel Studios 50:2
Angelson, Eric 42:3
Angress, Percy 31:1
Animal World, The (1956) 7:1
animation — see effects animation / cel animation / clay animation / computer generated imagery / go-motion animation / replacement animation / rotoscoping / stop-motion animation
animatronics 1:2 / 5:3 / 6:2 / 6:3 / 10:1 / 11:1 / 12:1 / 14:3 / 16:1 / 17:1 / 18:1 / 18:2 / 19:1 / 20:1 / 21:1 / 21:2 / 22:1 / 22:2 / 23:1 / 23:2 / 23:3 / 24:1 / 25:2 / 25:3 / 26:1 / 26:2 / 27:1 / 28:1 / 28:2 / 28:3 / 29:1 / 29:2 / 30:1 / 31:1 / 31:2 / 34:1 / 35:1 / 35:2 / 36:3 / 36:4 / 37:2 / 38:1 / 39:1 / 40:1 / 40:2 / 41:2 / 42:2 / 43:1 / 45:2 / 46:1 / 46:2 / 47:1 / 48:3 / 49:2 / 50:1
Aoki, Hirotsugu 46:2
Apocalypse Now (1979) 3:2

Apogee 1:1 / 2:3 / 10:2 / 15:1 / 21:2 / 23:2 / 31:1 / 40:1 / 45:3
appliance makeup 4:2 / 12:1 / 14:3 / 16:1 / 17:1 / 19:3 / 21:1 / 21:2 / 22:1 / 24:1 / 24:2 / 25:1 / 25:3 / 28:1 / 28:2 / 30:2 / 31:1 / 31:3 / 32:1 / 33:2 / 34:1 / 36:1 / 36:3 / 36:4 / 37:2 / 38:1 / 40:1 / 41:1 / 43:1 / 44:2 / 46:1 / 46:3 / 47:1 / 48:2 / 48:3 / 49:2 / 49:3
old-age makeup 12:1 / 24:2 / 28:2 / 33:2 / 46:1 / 46:3
Arbogast, Roy 5:3
Archer, Steven 5:2 / 12:2
Arias, Michael 46:2
Arkadon Motion Control 27:1
Armstrong, John 31:2
Associates & Ferren 4:2 / 30:1 / 42:3
Atlantis (— —) 7:1 / 15:3
Aupperle, James 12:2 / 19:3
Autobiography of Miss Jane Pittman, The (1974) 16:1
Available Light 15:2 / 35:2 / 37:2 / 44:1 / 45:1
Aykroyd, Dan 17:1 / 40:1
Baby: Secret of the Lost Legend (1985) 22:2
Back to the Future (1985) 24:2
theme park ride 46:2
Back to the Future II (1989) 43:2
Back to the Future III (1990) 43:2
Backdraft (1991) 48:1
Badham, John 12:3 / 28:3
Baer, Dale 35:1
Baer, Jane 35:1
Bailey, Charlie 11:1 / 18:1 / 45:3
Bailey, Robert 9:1
Baker, Don 9:1 / 14:2
Baker, Graham 36:1
Baker, Rick 11:1 / 16:1 / 23:3 / 46:1 / 48:2
Balsmeyer & Everett 36:3
Balsmeyer, Randall 36:3
Barron, Craig 11:1 / 18:1 / 25:1 / 26:2 / 29:1 / 30:3 / 31:2 / 45:1 / 49:3
Barron, Thomas 37:1 / 45:1
Barwood, Hal 6:2
Bass, Saul 3:3
Batman (1989) 41:1
Batteries Not Included (1987) 34:2
Bauman, Carol 49:2
Beast from 20,000 Fathoms, The (1953) 5:1
Beast of Hollow Mountain, The (1956) 7:1
Beattie, Scott 43:1
Beatty, Warren 44:2

Beauty and the Beast (TV) 46:1
Beck, Mat 10:2 / 31:3
Beck, Steve 42:1
Bedig, Sass 46:3
Beetlejuice (1988) 34:1
Bell, John 43:2 / 48:2
Belson, Jordan 14:1
Belyeu, Jon G. 48:2
Berg, Jon 17:1 / 28:1 / 37:2
Berkshire Ridefilm Corporation 46:2
Berry, David 24:1
Bertino, Tom 32:2 / 40:1
Beswick, Doug 3:1 / 21:1 / 23:3 / 27:1 / 34:1
Betuel, Jonathan 17:2 / 23:3
Big Trouble in Little China (1986) 28:2
Bigelow, Michael 39:1 / 43:1
Birth of a Flivver, The (1917) 7:1
Bissell, Jim 48:2
Black Hole, The (1979) 6:1
Black Scorpion, The (1957) 7:1
Blade Runner (1982) 9:1
Blalack, Robert 4:2 / 15:2
Blau, Patricia 48:2
Blinn, James F. 6:1
Blinn, Peter 8:1
Blob, The (1988) 36:4
Blue Thunder (1983) 12:3
bluescreen traveling mattes 2:1 / 2:3 / 4:2 / 5:2 / 6:2 / 10:2 / 13:1 / 15:2 / 19:2 / 20:1 / 21:2 / 23:2 / 29:2 / 31:1 / 31:3 / 35:1 / 35:2 / 37:3 / 39:1 / 40:2 / 41:2 / 42:3 / 43:1 / 44:1 / 45:1 / 49:1 / 49:3 / 50:1
front projection bluescreen 15:2 / 20:1 / 21:2 / 23:2
underwater bluescreen 39:1
Boates, Brent 31:3 / 36:2
Body and Soul (1930) 15:3
'Body Wars' 46:2
Bohanna, Peter 21:2
Bolles, Mike 43:2
Booth, Richard 45:1
Boss Film Corporation 17:1 / 20:1 / 25:3 / 26:1 / 28:2 / 31:3 / 33:3 / 36:2 / 42:1 / 44:1
Bottin, Rob 14:3 / 16:1 / 22:3 / 31:2 / 32:1 / 43:1 / 45:2
Bradbury, Ray 12:1
Brainstorm (1983) 14:2
Brazil (1985) 38:1
Breton, Brooke 49:3

Brevig, Eric 43:1 / 49:1
Brewer, Art 42:2
Brooks, Mel 31:1
Bruno, John 10:1 / 17:1 / 25:3 / 26:1 / 39:1
Bryan, Bill 17:1
Buck Rogers in the 25th Century (1979) 6:1
Budd, George 22:2
Buena Vista Visual Effects Group 44:2
Buff, Conrad 17:1 / 20:1
Buff, Laura 48:3
bullet hits 45:3 / 46:3 / 48:2
Bunnett, David 6:2
Burg, Steve 39:1 / 43:1
Burkett, Deena 8:1
Burks, Jeff 43:1
Burman Studios, The 24:2
Burman, Bari 24:2
Burman, Tom 24:2
Burns, Bob 16:1
Burton, Rob 43:1
Burton, Tim 34:1 / 41:1
Butler, Robert 15:2
cable-actuated puppetry — see animatronics
Caglione, John Jr. 44:2
Cameron, James 21:1 / 27:1 / 39:1 / 47:1
Cameron, Mike 39:1
Campbell, Bill 48:2
Campbell, Glenn 9:1
Campbell, Martin 48:3
Can-Dive Services 39:1
Cannom, Greg 24:1
Cantwell, Colin 6:1
Captain Eo (1986) 46:1
Cardinal, The (1963) 33:2
Carere, Frank 30:2
Carpenter, John 12:2 / 28:2
Carson, David 6:2 / 24:2 / 25:1 / 26:2 / 31:2 / 35:2 / 46:2
cartoon animation — see cel animation
Cast a Deadly Spell (1991) 48:3
Castle, Nick Jr. 17:2
Cavanaugh, Lawrence 46:3
Caveman (1981) 5:3 / 5:4
cel animation 11:2 / 25:3 / 35:1 / 48:2 / 49:1

Champion, Gregg 12:3
Chandler Group, The 42:1 / 44:2
Chase, Ken 24:2
Chayefsky, Paddy 4:2
Cheney, Kirk 28:1
Chesney, Peter 41:2
Chiang, Doug 44:1 / 47:1
Childress, Wade 25:1 / 29:1 / 30:3
Chiodo, Steve 32:1
Chris Walas Incorporated 19:1 / 25:1 / 28:l / 37:2 / 49:2
Cinema Research 12:3 / 14:3
Clark, Duane 17:1
Clash of the Titans (1981) 5:1 / 5:2
Clavadetscher, Charles 43:2 / 44:1 / 49:1
clay animation 22:1
Clayton, Jack 12:1
Clokey Productions 16:1
Close Encounters of the Third Kind (1977)2:2 / 5:3 / 11:2 / 12:3
Close Encounters of the Third Kind - Special Edition (1980) 2:2 / 11:2
cloud simulations 6:3 / 12:1 / 12:3 / 14:1 / 17:1 / 19:2 / 19:3 / 23:1 / 24:1 / 31:2 / 38:1 / 45:3
cloud tank effects 6:3 / 10:1 / 12:1 / 12:3 / 15:2 / 17:1 / 19:3 / 26:1
Cobb, Ron 17:2 / 27:1 / 39:1 / 43:1
Cobos, Ralph 1:2
Cocoon (1985) 24:1
Cohen, Larry 12:2 / 16:1
Collis, Jack 45:1
Colossal Pictures 14:1 / 28:1 / 29:3
Colver, Clint 12:1 / 31:1
Coming to America (1988) 46:1
Composite Image Systems 37:1
compositing — see digital compositing / optical compositing / video compositing
computer generated imagery 4:2 / 6:1 / 8:1 / 12:1 / 17:2 / 20:1 / 23:1 / 26:2 / 29:1 / 35:2 / 37:1 / 38:1 / 39:1 / 40:2 / 42:1 / 43:2 / 45:1 / 45:2 / 45:3 / 47:1 / 49:1 / 49:3 / 50:1 / 50:2
computer graphics — see computer generated imagery / digital image processing / morphing
Computer Image Corporation 6:1
Comstock, Sam 3:1 / 6:2 / 6:3 / 11:1
Conn, Peter 32:1 / 50:2
Connolly, Jennifer 48:2
Conti, Walt 29:1 / 39:1
Conversation, The (1974) 3:2
Conway, Lyle 22:1 / 30:1 / 36:4
Conway, Richard 30:1 / 38:1
Cook, Randall William 5:4 / 12:2 / 17:1 / 30:2

Cooper, Merian C. 7:1
Coppola, Francis Ford 3:2 / 11:2 / 46:3
Cornfeld, Stuart 28:1
Cosmos (TV) 6:1
Costa, Robert 47:1
Cowan, Chris 32:1
Cranham, Tom 9:1
Creation (— —) 5:1 / 7:1
creature effects — see animatronics / appliance makeup / creature suits
creature suits 1:2 / 4:2 / 11:1 / 14:3 / 16:1 / 17:1 / 22:1 / 22:2 / 23:1 / 24:1 / 25:1 / 26:1 / 27:1 / 28:1 / 28:2 / 29:2 / 30:2 / 31:1 / 32:1 / 40:1 / 45:2 / 46:1 / 48:3 / 50:1
Creature Shop, The 40:1
Crescenzo, Philip 50:1
Crist, Paula 22:2
Cronenberg, David 16:1 / 28:1 / 36:3 / 49:2
Cronenweth, Jordan 4:2
Crump, Christopher 29:2
Culnan, Tom 20:1 / 46:2
Curious Pets of Our Ancestors (1917) 7:1
Curry, Dan 37:1
CWI — see Chris Walas Incorporated
Dancing Pirate, The (1936) 7:1
Danforth, Jim 5:2 / 5:4 / 14:3
Dante, Joe 12:2 / 14:3 / 19:1 / 22:3 / 32:2
Dark Star (1974) 2:2
Darnell, Henry 48:2
Daulton, Peter 34:2 / 42:1 / 43:2 / 48:2 / 49:3
David Stipes Productions 50:2
Davies, Craig 32:1 / 41:2 / 45:2
Davis, Desmond 5:2
Davison, Jon 32:1 / 45:2
Dawley, Herbert M. 7:1
Dawson, Douglas 4:1
??????????????????
Day After, The (1983) 15:2
De Laurentiis, Raffaella 21:2
De Rossi, Gianetto 21:2
Dead Ringers (1988) 36:3
Death Race 2000 (1975) 16:1
Deepstar Six (1989) 37:3
deGraf / Wahrman 45:2
Delgado, Marcel 7:1
Demon Seed (1977) 6:1

Demos, Gary 6:1 / 17:2 / 20:1
Dern, Bruce 8:2
Design Setters 39:1
Deutschendorf, Ron 40:1
Devis, James 21:2
Dewe, Bryan 49:2
Di Francesco, David 26:2
Di Sarro, Al 42:1 / 45:3 / 50:1
Diaz, Ken 31:1
Dick Tracy (1990) 44:2
Dicken, Roger 1:2
Die Hard (1988) 36:2
Die Hard 2 (1990) 45:3
Dierdorff, Chris 15:2
digital compositing 26:2 / 40:2 / 45:1 / 47:1 / 48:1 / 48:2 / 49:1 / 50:2
Digital Effects 8:1
digital effects — see computer generated imagery / digital image processing / morphing
digital image processing 35:2 / 40:2 / 43:2 / 45:3 / 47:1 / 49:1 / 49:3
wire removal 43:2 / 45:3 / 47:1
Digital Productions 17:2 / 20:1
Dilley, Leslie 39:1
Dindal, Mark 48:2
Dinosaur and the Missing Link, The (1917) 7:1
dinosaur effects 5:1 / 5:4 / 7:1 / 15:3 / 22:2 / 23:3 / 46:2
Dippe, Mark 47:1
Dittert, Les 40:2 / 47:1
Dixon, Jamie 47:1
Donahue, Tim 4:1
Donen, Peter 12:3 / 14:3 / 31:1 / 40:1 / 45:3
Donner, Richard 24:2
Dorney, Roger 10:2 / 23:2 / 31:1
double-pass traveling mattes 1:1 / 10:2 / 12:3 / 15:1 / 19:2 / 31:1
Double Suicide (1982) 11:2
Doublin, Tony 50:2
Dougherty, Joseph 48:3
Dow, Don 11:1 / 18:2 / 22:3 / 25:1 / 29:1
Dow, James 8:2
Dracula (1979) 5:3
Dragonslayer (1981) 6:2
Dream Quest Images 12:3 / 14:3 / 18:1 / 19:1 / 19:2 / 28:1 / 36:4 / 39:1 / 43:1
Dreamscape (1984) 19:3
Drexler, Doug 44:2
dry-for-wet photography — see underwater simulation

Dryer, David 9:1 / 15:1
Dudman, Nick 41:1
Dune (1984) 21:2
Dungan, Bill 8:1
Dupuis, Stephan 25:1 / 28:1 / 37:2 / 40:2
Durinski, Art 22:3
Dutra, Randy 30:3
Dutton, Syd 21:2 / 42:3
Dyer, Lee 8:1 / 12:1
Dykstra, John 1:1 / 2:3 / 4:2 / 8:2 / 10:2 / 21:2 / 23:2
Eaglery 45:1
Eastwood, Clint 10:2
Edlund, Richard 2:1 / 6:3 / 10:1 / 13:1 / 17:l / 20:l / 25:3 / 26:l / 28:2 / 31:3 / 36:2 / 44:1 / 50:1
EEG — see Entertainment Effects Group
effects animation 1:1 / 2:3 / 3:1 / 6:2 / 6:3 / 8:1 / 9:1 / 10:1 / 10:2 / 11:1 / 11:2 / 12:1 / 13:1 / 14:2 / 14:3 / 15:1 / 15:2 / 17:1 / 18:2 / 19:2 / 21:1 / 21:2 / 23:1 / 23:2 / 23:3 / 24:1 / 24:2 / 26:1 / 28:2 / 29:1 / 29:3 / 31:1 / 31:2 / 31:3 / 35:1 / 35:2 / 37:2 / 40:1 / 41:1 / 43:2 / 44:1 / 45:1 / 47:1 / 48:2 / 49:1
Effects Associates 5:4 / 14:3
EFX 16:1 / 23:3
Electric Image 47:1
electrical effects 2:3 / 6:2 / 19:2 / 21:1 / 28:2 / 30:1 / 35:2 / 37:2
electron microscopy 19:2 / 42:3
Elek, Zoltan 36:1
Elin, Larry 8:1
Ellenshaw, Harrison 8:1 / 12:1 / 44:1 / 44:2
Ellenshaw, Peter 44:2
Elliot, Don 35:1
Elliott, Peter 29:2
Ellis, John 18:1 / 24:2 / 26:2 / 34:2 / 35:2 / 40:1 / 48:2 / 49:1
Emerald Forest The (1985) 37:3
Empire Strikes Back, The (1980) 2:1 / 3:1 / 6:1
Enemy Mine (1985) 25:1
English, James 39:1
Enriquez, Thorn 40:1
Entertainment Effects Group 9:1 / 10:2 / 14:2 / 17:1 / 20:1
Eppolito, John 4:1
Ercolano, Gregory 45:2
Erland, Jonathan 23:2 / 31:1
Escape from New York (1981) 5:3 / 12:3
E.T.: The Extra-Terrestrial (1982) 11:1 / 12:3
Evans, Christopher 11:1 / 18:1 / 24:1 / 25:1 / 26:2 / 29:1 / 30:3 / 34:2 / 35:2
Evans, John 41:1
Everett, Gimel 50:2

Everybody's All-American (1988) 33:2
Exorcist The (1973) 16:1 / 33:2
Exorcist II: The Heretic (1977) 37:3
Explorers (1985) 22:3
explosions — see pyrotechnics
Fahey, Jeff 50:2
Fangmeier, Stefen 49:1
Fantasy II 19:1 / 21:1 / 39:1 / 42:2 / 47:1
Fante, John 32:2
Farino, Ernest D. 12:2 / 21:1
Farrar, Scott 18:2 / 30:3 / 35:1 / 48:1 / 49:3
Favila, Fernando 32:1
Ferren, Bran 4:2 / 30:1 / 42:3
Ferriter, Mike 42:1
Fichter, Rick 10:1 / 14:1 / 29:3 / 41:2 / 50:1
Film Effects 28:1 / 36:3
Fincher, David 50:1
Fink, Michael 19:2 / 36:4
Finnell, Michael 12:2 / 19:1 / 22:3
fire effects — see pyrotechnics
Firefox (1982) 10:2
Fitzsimmons, Patrick 10:1 / 11:1 / 18:1 / 18:2 / 42:1
Flash Gordon (1980) 6:1
Flesh Gordon (1974) 2:2 / 16:1
Flight of the Intruder (1991) 45:1
floor effects — see physical effects
Flowers, A.D. 46:3
Fly, Donald R. 31:3
Fly, The (1986) 28:1
Fly II The (1989) 37:2
flying harnesses 1:1 / 17:1 / 20:1 / 21:2 / 23:1 / 38:1 / 41:1 / 41:2 / 42:3 / 43:2 / 48:2 / 49:1
Fonseca, Gregg 41:2
forced perspective photography 21:2 / 27:l / 30:2 / 32:2 / 39:l
Ford, Sandra 43:2
foreground miniatures — see forced perspective photography
Foreman, Jon 42:1
4-Ward Productions 42:2 / 47:1 / 48:3
Francis, Freddie 21:2
Franco, Larry 48:2
Frankenstein (— —) 7:1
Franklin, Warren 18:1 / 18:2 / 25:1 / 30:3
French, Edward 49:3
Freund, Mark 30:2

Fright Night (1985) 25:3
Frobos, Linda 17:1
Froman, Richard 6:1
front projection 4:1 / 8:2 / 9:1 / 10:2 / 15:2 / 20:1 / 21:2 / 22:1 / 23:2 / 45:1
frontlit-backlit traveling mattes 3:1 / 5:4
Fullerton, Carl 4:2
Fulmer, Joe 42:1
Fulmer, Michael 3:1 / 11:1 / 25:1 / 40:2 / 44:3
Funke, Alex 39:1 / 43:1
Furniotis, John 36:3
Furst, Anton 41:1
Fury, The (1978) 16:1
Future General Corporation 1:1 / 46:2
Futureworld (1976) 6:1
Gale, Bob 43:2
Gardner, Tony 23:3 / 36:4 / 48:3
Garwood, Norman 49:1
Gaspar, Chuck 17:1 / 28:3 / 40:1
Gate, The (1987) 30:2
Gaudreault, Jacques 39:1
Gawley, Steve 24:1 / 30:3 / 35:1 / 43:2 / 48:2
George, William 9:1 / 24:2 / 32:2 / 40:1 / 44:3 / 49:3
George, Bruno 49:1
Gerard, Pete 17:1
Ghost (1990) 44:1
ghost effects 6:3 / 10:1 / 17:1 / 26:1 / 34:1 / 40:1 / 44:1 / 44:3
Ghost of Slumber Mountain, The (1918) 7:1
Ghostbusters (1984) 17:1
Ghostbusters II (1989) 40:1
Giant Behemoth, The (1959) 7:1
Gibbs, George 18:1 / 35:1 / 38:1 / 40:2 / 50:1
Gibson, Brian 26:1
Gibson, Julia 47:1
Giger, H.R. 1:2 / 26:1
Gill, Jim 50:2
Gill, Spencer 5:4
Gilliam, Terry 38:1
Gillis, Alec 36:1 / 42:2 / 50:1
gimbal rigs 10:1 / 20:1 / 28:1 / 40:1 / 42:1 / 45:1 / 48:2
Gioffre, Rocco 12:3 / 14:3 / 19:1 / 32:1 / 45:2
Girl in the Moon, The (1929) 25:2
glass paintings 7:1 / 15:3
Gleason, Michael 35:2

Glen, John 33:1
Gluck, Lewis 46:2
go-motion animation 3:1 / 6:2 / 11:1 / 13:1 / 26:2 / 30:3 / 36:4 / 41:2 / 45:2 / 47:1
Goddard, Gary 31:3
Godfather, The (1972) 33:2 / 46:3
Godfather Part II, The (1974) 46:3
Godfather Part III, The (1990) 46:3
Gold, Diana 9:1
Goldberg, David 39:1 / 45:1
Goldblatt, Stephen 4:1
Golden Child, The (1986) 30:3
Golden Voyage of Sinbad, The (1974) 5:1
Goonies, The (1985) 24:2
Gordon, Ralph 29:1
Gorillas in the Mist (1988) 46:1
Gottlieb, Carl 5:4
Graham, Bob 45:3
Grantham, Robin 22:1
Gredell, Mark 23:2
Green, Chris 31:2
Green, Richard 49:3
Green, Whitney 14:1
Greenberg, Robert 33:3
Greenlite Effects 19:2
Gremlins (1984) 19:1
Gremlins 2: The New Batch (1990) 46:1
Gress, Ron 29:2
Greystoke: The Legend of Tarzan, Lord of the Apes (1984) 16:1
Groshelle, William 29:3
Gross, Michael C. 17:1 / 40:1
Guillermin, John 29:2
Gutierrez, Gary 14:1 / 29:3
Hall Allen 48:1
Hall Robert 9:1
Hammeras, Ralph 7:1 / 15:3
hand puppets 1:2 / 6:2 / 19:1 / 25:3
Hangar 18 (1980) 6:1
hanging miniatures — see forced perspective photography
Harlin, Renny 45:3
Harrison, Lee 6:1
Harrison, Patt 21:2
Harry and the Hendersons (1987) 46:1
Harry Truman, Plain Speaking (TV) 33:2

Harryhausen, Ray 5:1 / 5:2 / 7:1
Hatt, John 21:2
Haworth, Ted 34:2
Hayes, Ron 6:1
Healy, Janet 47:1
Herbert, Frank 21:2
Herrmann, Karl 11:1
Heschong, Greg 23:2
Hester, Tom 23:3 / 24:1
Higgins, Clark 20:1
Hinkle, Jack 9:1
Hinton, Shelley 8:1
Hirsh, Edward 18:1 / 49:1
Holland, Tom 25:3
Hollander, Richard 9:1 / 14:2 / 47:1 / 50:1
Hollister, Robert 12:3
Hollister, Thomas 12:3
Holman, Jena 14:1 / 15:2
holographic simulation 43:1 / 43:2
Homer & Associates 32:1 / 50:2
Honey, I Shrunk the Kids (1989) 41:2
Hook (1991) 49:1
Hooper, Tobe 10:1 / 23:2
Hora, John 14:3 / 19:1
Hosking, Craig 48:2
Hoskins, Bob 35:1
Houston, Rent 38:1
Howard, Ron 24:1 / 35:2 / 48:1
Howard, Stein 24:2
Howling, The (1981) 12:2
Hudson, Ernie 40:1
Hudson, Guy 25:1 / 37:2
Hudson, Hugh 16:1
Huff, Phil 44:2
Hughes, John 45:1
Hunger, The (1983) 12:2 / 33:2
Hunt, Brad 50:2
Hunt for Red October, The (1990) 42:1
Hunt, Jill 50:2
Hunte, Otto 25:2
Hurd, Gale Anne 21:1 / 27:1 / 36:1 / 39:1 / 42:2 / 48:3
Hurley, Adrian 45:1
Huston, Paul 10:1 / 22:2 / 34:2 / 35:2 / 45:3 / 48:1

Huttula, Gerhard 25:2
Hyams, Peter 4:1 / 20:1
HydroImage 39:1
Hynek, Joel 33:3
Iguchi, Frederick 12:3 / 36:4
HI — see Information International
Illusion Arts 30:2 / 31:1 / 41:2 / 42:2 / 42:3
ILM — see Industrial Light & Magic
Image Engineering 41:2
Image G 37:1 / 45:1
In the Villain's Power (1917) 7:1
Incredible Melting Man, The (1978) 16:1
Incredible Shrinking Woman, The (1981) 5:3
Indiana Jones and the Last Crusade (1989) 40:2
Indiana Jones and the Temple of Doom (1984) 18:1
Industrial Light & Magic 2:1 / 3:1 / 6:2 / 6:3 / 10:1 / 11:1 / 18:1 / 18:2 / 22:3 / 24:1 / 24:2 / 25:1 / 26:2 / 29:1 / 30:3 / 31:1 / 31:2 / 32:2 / 34:2 / 35:1 / 35:2 / 39:1 / 40:1 / 40:2 / 42:1 / 43:2 / 44:1 / 44:3 / 45:3 / 46:2 / 47:1 / 48:1 / 48:2 / 49:1 / 49:3
Information International 6:1 / 8:1
Innerspace (1987) 32:2
Introvision 4:1 / 45:1
Irons, Jeremy 36:3
Irwin, Mark 28:1
Isaac, Jim 28:1 / 49:2
It Came from Beneath the Sea (1955) 5:1
It Lives Again (1978) 16:1
It's a Mad, Mad, *Mad, Mad World* (1963) 7:1
It's Alive (1974) 16:1
Jaffe, Steven-Charles 37:2 / 49:3
Jason and the Argonauts (1963) 5:1
Jaws (1975) 5:3
Jaws 2 (1978) 5:3
Jein, Greg 2:2 / 10:2 / 19:2 / 34:2 / 36:4 / 42:1 / 42:3
Jenson, George 20:1 / 28:2
Jessup, Harley 32:2 / 40:1 / 42:1 / 49:1
Jet Propulsion Labs 6:1
Joblove, George 29:1 / 35:2 / 42:1
Johnson, Brian 6:2 / 27:1
Johnson, Paul 31:1
Johnson, Steve 17:1 / 25:3 / 26:1 / 28:2 / 39:1
Johnston, Joe 3:1 / 6:3 / 41:2 / 44:3 / 48:2
Jones, David 29:2 / 50:1
Jones, Edward 30:3 / 31:2 / 35:1

Jones, Val 22:1
Joyce, Michael 21:1 / 47:1
Joyce, Sean 25:1 / 31:2
Just Imagine (1930) 15:3
Kagel, James 22:2
Karas, Gary 48:1
Kaufman, Philip 14:1
Kay, Douglas Scott 26:2 / 29:1 / 35:2 / 39:1
Kean, Katherine 15:2 / 35:2 / 44:1 / 45:1
Keeton, Jonathan 50:2
Kelly, Michael 20:1
Kelsey, Dave 29:2
Kentucky Fried Movie, The (1977) 16:1
Kershner, Irvin 2:1 / 3:1 / 15:1 / 45:2
Kettelhut, Erich 25:2
Khmara, Ed 25:1
Kick Me (1975) 11:2
Kimberlin, Bill 18:2 / 24:1 / 25:1
King Kong (1933) 5:1 / 7:1
King Kong (1976) 16:1
King Kong Lives (1986) 29:2
Kirby, Troy 39:1
Klassen, Walter 36:3
Kleinow, Peter 5:4 / 19:1 / 21:1 / 47:1
Knatz, Nikita 15:2
Knoll, John 32:2 / 35:2 / 39:1
Koneval, Kevin 44:2
Kosakura, Steve 50:1
Kovacs, Bill 6:1
Kozachik, Peter 32:2
Krepela, Neil 6:3 / 10:1 / 11:1 / 17:1 / 20:1 / 25:3 / 26:1
Kriemhild's *Revenge* (1924) 25:2
Kroyer, Bill 8:1
Krull (1983) 12:2
Krzanowski, Tad 34:2 / 35:2 / 42:1
Kuehn, Bradley 48:1 / 49:3
Kunstmann, Ernst 25:2
Kuran, Peter 6:2 / 14:3 / 19:1 / 19:2 / 19:3 / 32:1 / 34:1 / 41:2 / 45:2
Kurtz, Gary 22:1
L.A. Effects Group 27:1
Lamont, Peter 27:1
Landis, John 14:3 / 16:1
Landon, Richard 47:1

Lang, Fritz 25:2
Langston, Donna 50:1
Lantieri, Michael 29:1 / 35:1 / 40:2 / 43:2 / 49:1
Lapish, Steve 32:1
Lasaine, Paul 44:2
laser applications 1:1 / 1:2 / 2:3 / 10:1 / 23:2
Laserblast (1978) 2:2
Lasseter, John 26:2
Last Days of Pompeii, The (1935) 7:1
Last Starfighter, The (1984) 17:2
Lauritson, Peter 37:1
Lawnmower Man, The (1992) 50:2
Lawrence, Tim 23:3 / 34:1 / 40:1
Lazzarini, Rick 31:1 / 40:1
Lee, Danny 6:2
Legato, Robert 37:1
Leonard, Brett 50:2
Leonard Part 6 (1987) 37:3
Lepkowsky, Kelly 28:1 / 37:2 / 49:2
Levinson, Barry 26:2
Lichtwardt, Ellen 18:2 / 24:1 / 26:2 / 30:3
Lifeforce (1985) 23:2
lightning effects — see electrical effects
Limber, Michael 50:2
Ling, Van 47:1
Lisberger, Steven 8:1
Liska, Laine 41:2 / 46:2 / 50:1
Lithgow, John 20:1
Little Big Man (1970) 33:2
Little Shop of Horrors (1986) 30:1 / 37:3
Live and Let Die (1973) 16:1
Living Buddhas (1923) 25:2
Living Daylights, The (1987) 33:1
Lloyd, Michael 44:2
Lombardi, Joe 45:1 / 46:3
Loncraine, Richard 25:1
Looker (1981) 6:1
Lost World, The (1925) 7:1 / 15:3
Lost World, The (1960) 7:1
Lucas, George 2:1 / 3:1 / 3:2 / 6:3 / 13:1 / 18:1 / 35:2 / 40:2
Lupidi, Tony 50:2
Luskin, Jonathan 35:2 / 43:2
Lynch, David 21:2

Lyons, Robert 42:3
Maar, Pons 22:1
MacDonald, Bob Sr. 19:1
macrophotography 3:3 / 37:3
MA.*I* — see Mathemathical Applications Group
Magicam 2:2
Mahan, Shane 36:1 / 47:1
makeup effects — see appliance makeup / animatronics / creature suits
Maley, Alan 6:2 / 6:3
Malmberg, Mark 50:2
Malzahn, Richard 41:2
Man on Half Moon Street, The (TV) 33:2
Mangini, Mark 19:1 / 22:2
Mann, Jeff 29:1 / 35:2
Marems, Laurie 21:2
Marinoff, Caren 23:2
marionettes 10:1 / 17:1 / 25:3
Mark Twain Tonight! (TV) 33:2
Marks, Kim 30:3 / 31:2 / 32:2 / 49:1
Marquand, Richard 13:1
Marsh, Terence 42:1
Marshall, Frank 11:1 / 35:1 / 40:2
Mashimo, Fumi 30:2
Maslansky, Paul 22:1
Masters of the Universe (1987) 31:3
Masters, Anthony 21:2
Matakovich, Jeff 39:1 / 43:1
Mathemathical Applications Group 6:1 / 8:1 / 12:1
matte paintings 1:1 / 2:1 / 6:2 / 6:3 / 9:1 / 10:1 / 11:1 / 12:1 / 12:3 / 13:1 / 14:2 / 14:3 / 15:1 / 15:2 / 17:1 / 18:1 / 18:2 / 19:1 / 19:2 / 20:1 / 21:2 / 24:2 / 25:1 / 25:3 / 26:2 / 29:1 / 30:2 / 30:3 / 31:1 / 31:2 / 31:3 / 32:1 / 34:2 / 35:2 / 36:4 / 38:1 / 39:1 / 40:1 / 40:2 / 41:1 / 42:2 / 42:3 / 43:1 / 44:2 / 45:1 / 45:2 / 45:3 / 48:1 / 48:2 / 48:3 / 49:1 / 49:3 / 50:1
Matte World 45:1 / 49:3
Mattingly, David 44:2
Matza, Joe 37:1
McAlister, Michael 11:1 / 18:1 / 24:2 / 35:2 / 40:2 / 45:3
McClung, Pat 27:1 / 39:1
McCune, Grant 10:2 / 31:1
McDonald, Richard 4:2
McEnroe, Shawn 23:3 / 24:1
McMurry, Greg 20:1
McTiernan, John 33:3 / 36:2 / 42:1
Mead, Syd 8:1 / 9:1 / 20:1 / 27:1 / 28:3

Meador, Phil 22:2
mechanical effects — see physical effects
Meddings Magic Camera 41:1
Meddings, Derek 41:1
Medjuck, Joe 17:1
Mei, David 42:3
Melton, Kent 48:2
Mendelson, Phil 37:1
Mesa, William 4:1 / 45:1
Metrolight Studios 43:1
Metropolis (1926) 25:2
Meyer, Nicholas 15:2 / 49:3
Michaelson, Dennis 31:3
Mickey's Naughty Nightmares (1917) 7:1
microphotography 14:2 / 19:2 / 37:3 / 42:3
Middleham, Ken 3:3
Middleton, Michael 23:2
Mighty Joe Young (1949) 5:1 / 7:1
Milius, John 45:1
Millar, Henry 20:1
Miller, Alvah 10:2
Miller, George 14:3 / 31:2
Miller, Ron 21:2
Mills, Michael J. 49:3
miniatures 1:1 / 1:2 / 2:1 / 2:2 / 2:3 / 4:1 / 8:2 / 9:1 / 10:1 / 10:2 / 11:1 / 12:1 / 12:2 / 12:3 / 13:1 / 14:1 / 15:1 / 15:3 / 17:1 / 18:1 / 18:2 / 19:2 / 20:1 / 21:1 / 21:2 / 22:2 / 23:1 / 24:1 / 24:2 / 25:1 / 26:1 / 27:1 / 29:1 / 29:2 / 29:3 / 30:1 / 30:2 / 30:3 / 31:1 / 31:3 / 32:2 / 33:1 / 34:1 / 34:2 / 35:1 / 35:2 / 36:2 / 36:4 / 37:1 / 37:3 / 38:1 / 39:1 / 40:1 / 40:2 / 41:1 / 41:2 / 42:1 / 42:2 / 42:3 / 43:1 / 43:2 / 44:1 / 44:2 / 44:3 / 45:1 / 45:3 / 46:2 / 47:1 / 48:1 / 48:2 / 48:3 / 49:1 / 49:3 / 50:1 / 50:2
Minkow, Mike 15:2
Mirano, Virgil 9:1
mirror distortions 2:3 / 6:3 / 23:2 / 40:1
Missing Link, The (1987) 46:1
Mittelman, Phillip 6:1 / 8:1
Mixon, Bret 47:1
models — see miniatures
Modern Props 32:1
Moehnke, Ted 18:2
Moen, Michele 44:2 / 50:1
Mongovan, Jack 35:1
Montenegro, Joe 48:1
Montgomery, Peter 44:2
Moon and Sixpence, The (TV) 33:2

Moonraker (1979) 33:1
Moonwalker (1989) 46:1
Moore, Randy 32:1
Morawski, Jerry 14:2
Moreau, Harry 10:2 / 23:2
Morpheus Mike (1917) 7:1
morphing 35:2 / 40:2 / 47:1 / 49:3 see also computer generated imagery / digital image processing
Morris, Jim 44:3
Morris, Thaine 14:1 / 20:1 / 36:2
motion control 1:1 / 2:1 / 2:3 / 3:1 / 6:2 / 9:1 / 10:1 / 10:2 / 11:1 / 12:3 / 13:1 / 14:1 / 14:2 / 15:1 / 18:1 / 18:2 / 19:2 / 20:1 / 21:2 / 27:1 / 28:1 / 30:3 / 31:1 / 31:2 / 34:1 / 34:2 / 35:1 / 37:1 / 39:1 / 40:2 / 41:1 / 41:2 / 42:1 / 42:3 / 43:1 / 43:2 / 44:1 / 45:1 / 46:2 / 47:1 / 48:2 / 49:1 / 49:3
Movie Magic 15:2
Mula, Richard 47:1
Mullen, Charles 18:2 / 24:2
multiplane effects 1:1 / 14:2
Munchhausen (1942) 25:2
Munro, Alan 34:1
Murch, Walter 22:1 / 3:2
Muren, Dennis 3:1 / 6:2 / 11:1 / 12:3 / 13:1 / 18:1 / 26:2 / 32:2 / 35:2 / 39:1 / 40:1 / 46:2 / 47:1
Murphy, Earle 14:1
Murray, Bill 40:1
Murton, Peter 29:2
My Science Project (1985) 23:3
Myers, Ken 49:3
Myers, Patrick 49:1
Mysterious Island (1961) 5:1
Naked Lunch (1992) 49:2
Narita, Hiro 48:2
Naud, Tom 4:1
Neidig, Buzz 37:2
Neil, Bill 10:1 / 17:1 / 26:1 / 28:2 / 31:3 / 36:2 / 39:1 / 44:2 / 45:3
Nelson, Kimberly 42:1 / 49:1
Neufeld, Mace 42:1
Neumeier, Edward 32:1
Never Say Never Again (1983) 15:1
Nibelungen, Die (1924) 25:2
Nicholson, Bruce 6:2 / 6:3 / 10:1 / 18:1 / 22:3 / 25:1 / 34:2 / 35:2 / 44:1
Nicholson, Sam 40:1
Night Skies (— —) 11:1 / 16:1
Nimoy, Leonard 18:2 / 29:1
1941 (1979) 2:2
Nischwitz, Theodor 25:2

Nolan, Barry 21:2 / 29:2
Norrington, Stephen 22:1 / 26:2
Norton, B.W.L. 22:2
Norton, John 8:1
Nosenchuck, Daniel 15:2
Notaro, Phil 23:3 / 27:1
nuclear blast simulations 15:2 / 19:3 / 47:1
O'Bannon, Dan 1:2 / 6:1
O'Brien, Austin 50:2
O'Brien, Willis 5:1 / 7:1 / 15:3
Octoman (1971) 16:1
Octopussy (1983) 33:1
Olson, Jeffrey 48:1
Olsson, Gregg 49:2
Omnibus Computer Graphics 22:3
Omnimax 46:2
One from the Heart (1982) 11:2
One Million Years B.C. (1967) 5:1
optical compositing 2:1 / 2:3 / 6:2 / 8:2 / 9:1 / 10:1 / 10:2 / 11:1 / 15:2 / 18:1 / 18:2 / 20:1 / 21:2 / 23:1 / 23:2 / 24:1 / 24:2 / 26:1 / 28:2 / 29:1 / 30:3 / 31:2 / 31:3 / 33:3 / 34:2 / 35:1 / 35:2 / 36:3 / 38:1 / 40:1 / 43:1 / 43:2 / 44:1 / 45:1 / 45:3 / 47:1 / 48:1 / 48:2
Optical House, The 4:2 / 42:3
Ostwald, Chris 22:1 / 30:1
Outland (1981) 4:1
Outsiders, The (1983) 11:2
Owens, Michael 18:1 / 31:2
Owyeung, Ease 10:1
Oxford Scientific Films 37:3
Oz, Frank 30:1
Pacific Data Images 47:1
Pahk, Tom 23:2
paintings — see glass paintings / matte paintings
Pal, George 5:1 / 25:2
Palmer, John 39:1
Pangrazio, Michael 10:1 / 11:1 / 18:1
Parks, Peter 37:3
Patrick, Robert 47:1
Pawlik, Dennis 32:1
PDI — see Pacific Data Images
Pearce, Ken 50:2
Pearson, Bill 4:1
Peerless Camera Company 38:1
Penn, Arthur 4:2

Pennington, Donald 39:1 / 45:1
Perisic, Zoran 22:1
Perpetual Motion Pictures 41:2
Petersen, Wolfgang 25:1
Peterson, Lorne 10:1 / 11:1 / 18:1 / 34:2 / 44:1 / 49:1
Peterson, Pete 7:1
Phase IV (1974) 3:3
physical effects 5:3 / 6:2 / 10:1 / 17:1 / 18:1 / 20:1 / 26:2 / 27:1 / 28:1 / 28:2 / 28:3 / 29:1 / 30:2 / 33:1 / 35:1 / 38:1 / 39:1 / 40:1 / 40:2 / 41:1 / 41:2 / 42:1 / 42:2 / 43:2 / 44:3 / 45:3 / 46:3 / 47:1 / 48:1 / 48:2 / 49:1 / 50:1 / 50:2
Picardo, Robert 22:3
pin-block photography 26:1 / 35:2 / 39:1
Pink Floyd — The Wall (1982) 37:3
Pinkham, Dan 15:2
Pinney, Clay 48:1
Pique Dame (TV) 33:2
Platek, Gary 6:3 / 10:1 / 17:1
Poltergeist (1982) 10:1
Poltergeist 2 (1986) 26:1
Post Group, The 37:1 / 44:1
Powell, Ivor 1:2
Praxis Film Works 15:2
Predator (1987) 33:3
Prehistoric Poultry (1917) 7:1
Price, Brick 39:1
Price, Steve 44:1
Prizzi's Honor (1985) 33:2
process photography — see front projection / rear projection
Pulse (1988) 37:3
puppet lip-sync 30:1 / 43:1 / 49:2
Puppetoons 5:1
puppetry — see animatronic puppets / go-motion animation / hand puppets / marionettes / puppet lip-sync / rod puppets / stop-motion animation
Puzzling Billboard, The (1917) 7:1
pyrotechnics 3:1 / 6:2 / 9:1 / 10:2 / 13:1 / 14:1 / 15:2 / 18:2 / 20:1 / 21:1 / 27:1 / 29:3 / 30:3 / 33:1 / 35:2 / 36:2 / 36:4 / 38:1 / 40:2 / 41:1 / 43:2 / 44:3 / 45:1 / 45:3 / 47:1 / 48:1 / 48:2 / 50:2
Q (1982) 12:2
Queen of Spades, The (TV) 33:2
radio control 10:2 / 18:1 / 29:1 / 33:1 / 39:1 / 40:1 / 44:3 / 45:1 see also animatronics
Rados International 42:1
Rados, Robert Jr. 42:1
Rae, Ted 23:3 / 34:1
Rafferty, Kevin 17:2

Raiders of the Lost Ark (1981) 6:3
Raimondi, Fred 37:1
Rain People, The (1969) 3:2
Ralston, Ken 3:1 / 6:2 / 13:1 / 18:2 / 24:1 / 29:1 / 30:3 / 35:1 / 43:2 / 48:2
Rambaldi, Carlo 1:2 / 11:1 / 16:1 / 21:2 / 29:2
Ramis, Harold 17:1 / 40:1
Raponi, Isadora 12:1 / 22:2
Rapp, Edward 42:3
Rappaport, Mark 37:2
Ratboy (1986) 46:1
Ray, Harrison 17:1
Real Time 50:2
rear projection 15:3 / 27:1 / 39:1 / 44:3 / 47:1
Reardon, Craig 10:1 / 11:1 / 14:3 / 19:3 / 24:2 / 30:2
Reel Efx 50:2
Rees, Jerry 8:1
Reeves, Bill 26:2
Regan, Chris 15:2 / 28:2 / 31:3
Reitman, Ivan 17:1 / 40:1
replacement animation 5:1 / 19:3 / 34:1
Repola, Arthur F. 20:1 / 24:2
Return of the Jedi (1983) 13:1
Return to Oz (1985) 22:1 / 37:3
reverse bluescreen 10:2 / 15:1 / 31:1
Reynolds, Norman 22:1
R.F.D. 10,000 B.C. (1917) 7:1
R / Greenberg Associates 33:3
Rhodaback, Gary 21:1
Rhythm & Hues 45:1
Richardson, Gillian 37:2
Richardson, John 27:1 / 33:1
Richter, W.D. 19:2
Riddle, Jay 39:1 / 47:1 / 49:3
Right Stuff, The (1983) 14:1
Ringwood, Bob 21:2 / 41:1
Ritchie, Michael 30:3
Robbins, Matthew 6:2 / 34:2
Robert Abel & Associates 1:1 / 6:1 / 8:1
Robertson, Stuart 43:2 / 44:1 / 45:3 / 48:1 / 48:2
RoboCop (1987) 32:1
RoboCop 2 (1990) 45:2
robotic characters 8:2 / 21:1 / 21:2 / 23:1 / 28:3 / 31:1 / 32:1 / 45:2 / 47:1
Rocketeer, The (1991) 48:2

Rod & Custom Construction 32:1
rod puppets 13:1 / 26:2 / 31:2 / 34:1 / 34:2 / 35:2 / 40:1 / 50:1
Rodis-Jamero, Nilo 10:1 / 22:3 / 42:3
Romano, Peter 39:1
Rose, Tim 22:1
Rosengrant, John 36:1 / 47:1
Ross, Chris 23:2 / 31:1
Rosseter, Tom 40:1
rotating sets 10:1 / 28:1
Rothacker, Watterson R. 7:1
Rothe, Caprice 11:1
rotoscoping 6:3 / 11:2 / 13:1 / 18:2 / 19:2 / 20:1 / 23:2 / 26:2 / 28:2 / 32:2 / 35:1 / 35:2 / 40:1 / 44:1 / 45:1 / 47:1
Rowohlt, Robert 42:3
Rubeo, Bruno 21:2
Rubin, Joseph 19:3
Ruiz del Rio, Emilio 21:2
Ruppel, Karl Ludwig 25:2
Rushlow, Nancy 15:2
Russell, Chuck 36:4
Russell, Ken 4:2
Rygiel, Jim 44:1 / 50:1
St. Amand, Tom 3:1 / 6:2 / 11:1 / 18:1 / 30:3 / 34:2 / 41:2 / 48:2
Salomon, Mikael 48:1
Sammon, Paul 45:2
Sandell, William 32:1
Sass, Steve 23:2
Saturn 3 (1980) 37:3
Sayer, Stanley 21:2
Scanlan, Neal 30:1
Scheele, John 8:1 / 22:2 / 23:3
Schiffer, Robert J. 12:1
Schlock (1971) 16:1
Schoedsack, Ernest B. 7:1
Schufftan, Eugen 25:2
Schumacher, Joel 16:1
Schumacher, Martha 29:2
Scifo, Robert 36:4
Scott, Elliot 40:2
Scott, Ridley 1:2 / 9:1 / 21:2
Scott, Tony 12:2 / 29:3
Seeber, Guido 25:2
Seldon, Nicholas 26:1 / 31:3

Serafine, Frank 15:2 / 50:2
7th Voyage of Sinbad, The (1958) 5:1
Seymour, Michael 1:2
Sforza, Fabrizio 38:1
Sharp, David 29:2
Shartle, Keith 12:3 / 19:2 / 36:4
Shatner, William 42:3
Shea, Michael 39:1
Shepherd, Robert 10:2
Short Circuit (1986) 28:3
Short, Robert 11:1 / 24:1 / 34:1
Shourt, Bill 8:2 / 23:2
Showscan 14:2
Shuftan, Eugene — see Schufftan, Eugen
Siceloff, Mary 43:1
Siegel, Mark 40:1
Siegfried (1924) 25:2
Silent Running (1971) 8:2
Silver, Jesse 12:1
simulator rides 46:2
Sinbad and the Eye of the Tiger (1977) 5:1
Sitnek, Susan 46:2
Skotak, Dennis 27:1 / 39:1 / 42:2 / 47:1
Skotak, Robert 27:1 / 39:1 / 42:2 / 47:1 / 48:3
Sky Hawk, The (1929) 15:3
Slagle Minimotion 45:1
Slagle, Pete 45:1
slitscan 1:1 / 8:2
Smith, Dick 4:2 / 16:1 / 33:2 / 46:3
Smith, Doug 23:2 / 31:1
Smith, Gordon 36:3
Smith, Kenneth 11:1 / 18:2 / 32:2 / 35:2
Smith, Thomas G. 41:2
Smith, Wayne 8:2 / 9:1
Smithies, Brian 21:2
Smythe, Doug 35:2 / 40:2 / 45:3 / 47:1
Snell, Richard 49:3
snow simulation 19:1 / 26:2 / 45:3
sodium screen traveling mattes 44:2
Soldier in Love (TV) 33:2
Something Is Out There (TV) 46:1
Something Wicked This Way Comes (1983) 12:1
Son of Kong, The (1933) 7:1

Sosalla, David 18:1 / 18:2 / 29:3 / 41:2
sound effects 3:2 / 7:1 / 15:2 / 19:1 / 21:2 / 22:2
Spaceballs (1987) 31:1
spacecraft effects 1:1 / 1:2 / 2:1 / 2:2 / 2:3 / 3:1 / 4:1 / 8:2 / 11:1 / 12:3 / 13:1 / 14:1 / 17:2 / 18:2 / 19:2 / 20:1 / 21:2 / 23:1 / 23:2 / 24:1 / 25:1 / 27:1 / 29:1 / 31:1 / 34:2 / 37:1 / 42:3 / 43:1 / 46:2 / 49:3
Special Effects Unlimited 45:1
Spencer, James 14:3
Spielberg, Steven 2:2 / 6:3 / 10:1 / 11:1 / 11:2 / 14:3 / 16:1 / 18:1 / 19:1 / 24:2 / 40:2 / 44:3 / 49:1
Spier, Carol 49:2
Spivack, Murray 7:1
Splet, Alan 21:2
split-screen twinning effects 36:3 / 37:1 / 43:1 / 43:2
Spurlock, Robert 29:1 / 43:1
Squires, Scott 12:3 / 42:1
Squirm (1976) 16:1
Stan Winston Studio 21:1 / 33:3 / 36:1 / 47:1
'Star Tours' 46:2
Star Trek: The Motion Picture (1979) 1:1 / 2:2 / 2:3 / 6:1 / 11:2
Star Trek III: The Search for Spock (1984) 18:2
Star Trek IV: The Voyage Home (1986) 29:1
Star Trek V: The Final Frontier (1989) 42:3
Star Trek VI: The Undiscovered Country (1991) 49:3
Star Trek: The Next Generation (TV) 37:1
Star Wars (1977) 6:1 / 16:1
Starkey, Steve 35:1
Starman (1984) 46:1
Stears, John 4:1
Steffe, Michael 37:2
Stein, Howard 18:1 / 44:1
Stein, Mark 46:2
Steinheimer, R. Bruce 46:3
Stephan, Dave 8:1
Stephenson, John 22:1
Stern, Nick 35:2
Stetson Visual Services 43:1 / 44:2
Stetson, Mark 9:1 / 14:2 / 17:1 / 19:2 / 20:1 / 26:1 / 31:3 / 36:2
Stevens, Dave 48:2
Stevens, Larry 15:2
Stewart, Dave 9:1 / 14:2 / 20:1
Stipes, David — see David Stipes Productions
Stolz, Peter 29:3
stop-motion animation 2:1 / 3:1 / 5:1 / 5:2 / 5:4 / 6:2 / 7:l / 12:2 / 14:3 / 15:1 / 15:3 / 17:1 / 18:1 / 18:2 / 19:1 / 19:3 / 21:1 / 23:1 / 25:2 / 28:1 / 30:3 / 32:1 / 34:1 / 34:2 / 35:2 / 36:4 / 40:1 / 41:2 / 45:2 / 47:1 / 48:2

storm effects 5:3 / 10:1 / 12:1 / 40:2 / 45:3
Stout, William 31:3
Stover, Smokey 23:2
streak photography 1:1 / 8:2 / 11:2 / 20:1 / 42:3 / 44:1
Stromquist, Eben 31:1
Student of Prague, The (1913) 25:2
Sullivan, John 10:2 / 23:2
Sullivan, Mark 40:1 / 40:2 / 48:2 / 49:1
Sullivan, Michael 42:3
Sumner, Claudia 17:2
Sunshine Boys, The (1975) 33:2
Supergirl (1984) 37:3
Superman (1978) 37:3
Suskin, Mitchell 10:1 / 11:1
Swallow, John 23:2
Swarthe, Robert 11:2 / 12:3
Sweeney, Michael 50:1
Sweeney, Patrick 42:1
Swenson, Eric 21:2
Tabacco, Mike 42:3
Takacs, Tibor 30:2
Takahashi, Wes 24:1 / 24:2 / 35:2 / 43:2 / 48:2 / 49:1
Takeuchi, Peter 49:3
Tantin, Ron 12:1
Taplin, Jonathan 22:2
Taylor, Bill 21:2 / 30:2 / 31:1 / 41:2 / 42:2 / 42:3
Taylor, Richard W. 6:1 / 8:1 / 12:1
Taylor, Robert 46:2
Teitzell, Jay 6:1
Telephon (1977) 6:1
Terminator, The (1984) 21:1
Terminator 2: Judgment Day (1991) 47:1
Terreri, Bert 45:1
theme park applications 46:1 / 46:2
thermographic imagery 32:1 / 33:3
Therrien, Annick 26:1 / 28:2
Thing with Two Heads, The (1972) 16:1
Thing, The (1982) 12:2
This Is Cinerama (1952) 7:1
Thomas, John 37:2
Thorne, Rich 37:1
Thriller (1984) 16:1
Thundertracks 19:1 / 22:2

THX 1138 (1971) 3:2
Time After Time (1979) 6:1
Time Bandits (1981) 38:1
time-lapse photography 37:3
Tippett, Phil 3:1 / 6:2 / 30:3 / 32:1 / 35:2 / 40:1 / 41:2 / 45:2
Top Gun (1986) 29:3
Total Recall (1990) 43:1
'Tour of the Universe' 46:2
Towler, Jim 48:3
traveling mattes — see bluescreen traveling mattes / double-pass traveling mattes / frontlit-backlit traveling mattes / reverse bluescreen / rotoscoping / sodium screen traveling mattes
Tremors (1990) 42:2
Triple-I — see Information International
Tron (1982) 8:1
Trumbull, Don 23:2
Trumbull, Douglas 1:1 / 8:2 / 9:1 / 10:2 / 14:2 / 46:2
Turner, Susan 12:2
20 Million Miles to Earth (1957) 5:1
20,000 Leagues Under the Sea (1954) 15:3
Twilight Zone - The Movie (1983) 14:3
2010 (1984) 20:1
Uesugi, Yusei 45:3
UFO Incident, The (1975) 2:2
ultraviolet applications 10:2 / 12:3 / 15:1 / 19:2 / 31:1 / 49:3
underwater effects 15:3 / 24:1 / 29:1 / 32:2 / 39:1
underwater simulation 15:3 / 37:3 / 39:1 / 42:1
Underwood, Ron 42:2
Universal Hartland 6:1
Unsinn, Joe 28:2
Upson, Craig 20:1
Urbano, Tony 28:3
USFX 14:1 / 29:3
Valentine, Tom 23:2
Valley of Gwangi, The (1969) 5:1
Valley of the Mist (— —) 7:1
Van der Veer Photo Effects 21:2 / 29:2
Van der Veer, Frank 6:1
Van Thillo, Wim 49:2
Van Vliet, John 35:2 / 37:2 / 44:1
Vargo, Mark 17:1 / 20:1 / 25:3 / 26:1 / 40:1 / 45:1
VCE — see Visual Concept Engineering
Vecchitto, Bruce 42:1
Verhoeven, Paul 32:1 / 43:1

Vermont, Laurie 18:2
Verse, Danielle 21:2
Victoria Regina (TV) 33:2
video compositing 37:1 / 44:1 / 50:2
Video Image Associates 20:1 / 47:1
Videodrome (1983) 16:1
Vidgeon, Robin 37:2
Vidmax 28:1
View to a Kill, A (1985) 33:1
Viker, Neil 8:1
Vinton, Will 22:1
virtual reality 50:2
Viskocil, Joseph 21:1 / 47:1
Visual Concept Engineering 6:2 / 14:3 / 19:1 / 19:2 / 19:3 / 32:1 / 34:1 / 41:2 / 45:2
Vollbrecht, Karl 25:2
Wahrman, Michael 45:2
Walas, Chris 6:2 / 6:3 / 19:1 / 25:1 / 28:1 / 37:2
see also Chris Walas Incorporated
Walas, Mark 25:1 / 37:2
Walker, Kenneth 46:2
Wallach, Peter 42:3
Waller, Garry 17:1 / 20:1 / 26:1 / 28:2 / 31:3 / 44:1
Walters, Bruce 18:2 / 24:1 / 25:1 / 26:2 / 29:1 / 30:3 / 31:2 / 42:1 / 45:3 / 49:1
Walton, Harry 26:2 / 30:3
War Eagles (— —) 5:1 / 7:1
Warren, Gene 21:1 / 39:1 / 42:2 / 47:1
Wash, John 9:1 / 14:2
Watkins, Wanda 23:2
Watling, David 1:2
Watts, Robert 35:1 / 40:2
Weaver, Sigourney 17:1
Weed, Harold 28:1 / 37:2 / 49:2
Wegener, Paul 25:2
Welch, Bo 40:1
Werewolf (TV) 46:1
West, Kit 21:2 / 26:2
Western Images 50:2
Western Space & Marine 39:1
Westmore, Michael 31:3
Westworld (1973) 6:1
Whitlock, Albert J. 21:2
Whitlock, Mark 30:2
Whitney, John Jr. 6:1 / 17:2

Whitney, John Sr. 6:1
Who Framed Roger Rabbit (1988) 35:1
Who Is Harry Kellerman and Why Is He Saying Those Terrible Things About Me? (1971) 33:2
Wildfire 49:3
Williams, Richard 35:1
Williams, Steve 47:1
Willow (1988) 35:2
Wilson, Lee 28:1 / 36:3
Wilson, Mak 22:1 / 30:1
Wilson, Mark 17:1
Wilson, S.S. 28:3 / 42:2
Windell, Terry 17:1 / 20:1 / 25:3 / 31:3
Winfield, Gene 32:1
Winston, Stan 21:1 / 27:1 / 33:3 / 47:1 see also Stan Winston Studio
Winter, Ralph 22:3
wire rigs 14:1 / 17:1 / 20:1 / 21:2 / 23:1 / 26:2 / 29:1 / 29:3 / 33:1 / 34:2 / 38:1 / 41:1 / 41:2 / 42:1 / 43:2 / 44:3 / 45:1 / 45:3 / 46:2 / 47:2 / 48:2 / 49:1
Wise, Robert 1:1 / 2:3
Witches of Eastwick, The (1987) 31:2
Wonder Woman (TV) 2:2
Wonderworks 39:1
Wood, John 29:2
Wood, Michael 10:1 / 44:3
Wood, Oliver 45:3
Woodruff, Tom Jr. 36:1 / 42:2 / 50:1
Woods, David 36:3
Wooley, Peter 15:2
Worrington, Ken 21:2
Xaos 50:2
Yaeger, Larry 20:1
Yates, Peter 12:2
Yeatman, Hoyt 12:3 / 19:2 / 36:4 / 39:1
Yerxa, Alison 14:2
Young Sherlock Holmes (1985) 26:2
Yuricich, Matthew 9:1 / 12:3 / 20:1 / 25:3 / 31:3
Yuricich, Richard 8:2 / 9:1
Zardoz (1974) 37:3
Zemeckis, Robert 24:2 / 35:1 / 43:2
Ziff, Stuart 6:2 / 17:1 / 20:1 / 31:3 / 36:4
Zimmerman, Phil 6:1
Zoptic 22:1
Zucker, Jerry 44:1

CONGRATULATIONS
CINEFEX AND DON SHAY
On your 50th commemorative issue!
From Doug and all your friends at The Trumbull Company, Inc.
P.O. Box 847, Lenox, MA 01240 Phone: 413-637-0500 Fax: 413-637-1960
© 1992 TCI